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| Set# | Query |
|---|---|
| L1 | float$3 with rate$1 with note$ |
| L2 | variable with rate with obligation$ |
| L3 | taxable with float$3 with rate$1 with note$ |

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| L4 | debt adj3 obligation$2 |
| L5 | (tax adj exempt) with bond |
| L6 | municipality |
| L7 | collateral |
| L8 | purchas$3 with asset$2 |
| L9 | variable adj rate adj demand adj obligation$ |
| L10 | security with interest$1 |
| L11 | (interest investment) with default |
| L12 | l1 and l2 and l5 and l6 and l7 and l8 and l10 and l11 |
| L13 | l1 or l3 |
| L14 | l2 or l4 or l9 |
| L15 | l10 or l11 |
| L16 | l13 and l14 and l15 |
| L17 | l5 and l16 |
| L18 | l6 and l16 |
| L19 | l7 and l16 |
| L20 | l8 and l16 |
| L21 | l5 and l6 and l7 and l8 |
| L22 | l21 and l16 |

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Global debt market growth, security structure, and bond pricing.

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**Text:**

Global bonds represent a relatively new and innovative financing structure allowing a variety of public and private debtors to raise large amounts of funds at one time in the international financial markets. International bonds comprise foreign bonds, Eurobonds, and global bonds.

Foreign bonds are issued by debtors in another country from the currency of the capital market where the bonds are sold (e.g., a German company issues a U.S. dollar-denominated bond in New York City). A Eurobond is a security issued in a country different from the instrument's currency denomination (e.g., a Brazilian bank issues a U.S. dollar-denominated bond in Frankfurt, Germany). A global bond is simultaneously offered and sold in two or more geographic markets (e.g., a U.S. housing finance agency issues a U.S. dollar-denominated bond in New York, Frankfurt, and Singapore). Compared to a domestic bond, denominated in the currency of the country of its issue and its issuer, a global bond is comparable to a security issued both domestically and internationally.

There is an ample literature on different aspects of domestic and international bond issuance by companies and governments, bond structure, pricing, and risk. Little attention has been paid to the quickly evolving global bond market--whether for corporate, bank, public finance, or sovereign debt (see Jankus (1997) and Mohamed (1994)). We both describe the rapid growth of global bonds between the first issue in 1989 and early 2001 and provide a framework to compare the common features of global bonds by key groups of borrowers. We determine the factors that best explain the relative yield premium of a sample of fixed-rate U.S. dollar-denominated global debt issued in the primary financial market during this first decade in growth of the market. The empirical record should prove of interest to investors, financial officers, and investment bankers by providing a context to better understand the connection between bond pricing and risk.

GLOBAL BOND MARKET

Debtors issue bonds for a variety of reasons. Companies and banks borrow money to fund maturing debt, restructure asset/ liability risk, and provide economic capital to support growth. Governments and government agencies borrow money to fund maturing debt, finance specific projects or public infrastructure, cover balance of payment deficits, and increase foreign reserves.

Both public and private entities may find the global bond market more desirable than either their domestic market or other segments of the international market for several reasons. First, the global debt market may accept higher levels of risk, such as longer maturities, lower credit ratings, and additional embedded options, than domestic investors or international investors from only one country will tolerate.

Second, the global debt market may be able to absorb larger issues than a domestic, foreign, or Eurobond market will accept individually. The global bond allows public and private entities to go to the market fewer times to access a given amount of capital.

Third, the global debt market may allow a debtor to obtain funds at a lower interest rate than available in domestic markets if investors believe the inflation-adjusted value of nominal debt denominated in a domestic currency will be eroded by purchasing power loss, widening credit spreads, or declining country risk quality. Or, the global debt market may allow a debtor to raise funds more efficiently and cheaply by relying on one large global bond issue rather than several smaller domestic, foreign, or international issues if there are economies of scale in the issuance process.

Regardless of the factors that support issuance of a global bond versus a more conventional debt instrument, the market has grown quickly in the space of just one decade.

Market Growth

The World Bank issued the first US$1.5 billion global bond in October 1989. Exhibit 1 reports the annual number of global bonds issued and the U.S. dollar-equivalent amount of funds raised annually between 1989 and early 2001.

The U.S. dollar-equivalent amount of funds raised between 1990 (the first full year of issue) and 2000 (the last full year of the period

analyzed) increased at an annual compound rate of almost 45%. The gross amount of funds raised via global bonds increased each year during the initial decade. The global bond market is large and expanding quickly.

The number of annual global issues increased by about 40% in the decade, but in an erratic pattern. The number of bonds issued declined following the U.S. recession of 1990-1991, the Asian crisis of 1997, and the Brazilian crisis of 1999. We often see a flight to safety from an international instrument to investors' domestic market in periods of global crisis or stress.

The global bond market allows debtors to raise large amounts of funds at one time. The average size of a global bond issued during the first decade was US$670 million. And the average size of an issue increased to over US$1 billion in the last two full years analyzed. Approximately 42% of the global bonds issued during the first decade were issued between 1999 and 2001, but those issues raised about 62% of the U.S. dollar-equivalent funds.

The global bond allows a debtor to raise a large amount of funds with one issue; clearly, debtors have relied on the global bond to raise progressively larger amounts of funds as both investors and borrowers became comfortable with the instrument and the market. The US$542 billion of global debt issued in 2000 constituted 47% of the net international capital market debt sold during that year alone (BIS Quarterly Review (2001)).

Bond Structure

The 2,705 global bonds issued between late 1989 and early 2001 were denominated in 22 different currencies. The market accepts a variety of currencies, but the U.S. dollar accounts for more than 86% of both the number of issues and the amount of funds raised.

Exhibit 2 shows the distribution of currencies in the first ten years of global bond issuance. Other bond currency denominations that exceed either 1% of the total number of issues or 1% of the total amount of funds raised include: the euro, the Japanese yen, the British pound sterling, and the Canadian dollar. We focus on the U.S. dollar-denominated global bond, given its overwhelming importance to the market.

Exhibit 3 describes the distribution of global bond structures between 1989 and 2001. Global bonds are mostly structured as fixed-rate instruments. Approximately two-thirds of the global bond issues and almost 80% of the funds raised have been fixed-rate debt. Fixed-rate bonds expose investors to market risk that increases with the effective duration of the **security** and the volatility of **interest** rates.

Floating-rate bonds constituted almost 30% of the global bonds issued, but provided less than 20% of the funds raised. Floating-rate bonds expose debtors to a higher cost of funds should interest rates rise with the market index applicable to the bond's interest rate structure.

Zero-coupon bonds constituted almost 4% of global issues, but provided a negligible amount of funding. Only 1% of the global debt included an equity option (i.e., convertible from debt to equity or equity warrants) or a term option.

We focus on the fixed-rate bond structure, given its importance in the market. Market risk for any fixed-rate security increases with effective duration, or the average absolute percentage change in the price of a security, given a plus or minus 1% change in yield. Effective duration increases with the term to maturity of the bond and is reduced with the coupon or rate attached to the bond.

Exhibit 4 illustrates the distribution of maturity for 1,806 fixed-rate global bonds by currency of debt. The average maturity of a fixed-rate global bond is approximately 11.6 years. Global bonds have been sold with terms that range from nine months to over 100 years. For currencies with at least 25 issues, average terms range from 12-plus years for bonds denominated in both the British pound sterling and the U.S. dollar to 8 years for the euro. The fixed-rate global bond is primarily a medium-term issue.

Issuer

Exhibit 5 illustrates the distribution of issuers relying on the fixed-rate global bond. A wide variety of borrowers have issued global debt. Private finance firms such as American Express or Boeing Capital account for 45% of the number of global bonds sold but less than 20% of global debt funds raised. Public finance organizations, on the other hand, such as the China Development Bank or Korea Development Bank raised almost 40% of the funds from just 18% of the issues.

Other key sectors obtaining funds from the global bond market include: central governments (e.g., Canada or the Federative Republic of Brazil); supranational organizations (e.g., the International Bank for Reconstruction and Development or the International Finance Corporation); private banks (e.g., Abbey National PLC or Banco de Comercio Exterio de Colombia SA); and private corporations (e.g., Ford Motor Company or Matsushita Electric Industrial Company Ltd.). Overall, many private firms and banks and government entities have found it advantageous to raise funds by a global bond rather than either a domestic bond or a more traditional international bond.

The global bond is clearly an instrument that has found quick acceptance among both surplus lenders and deficit borrowers. It has had a phenomenal rate of growth during its first decade. Governments, banks, corporations, and supranational organizations alike have taken advantage of the innovative financing vehicle.

FIXED-RATE U.S. DOLLAR-DENOMINATED GLOBAL BOND SAMPLE

Of the 2,705 global bonds issued between 1989 and 2001, about 56% (1,507 bonds) are fixed-rate U.S. dollar-denominated securities. We evaluate the pricing of only 1,469 of the 1,507 bonds because data are incomplete for 38 issues.

Exhibit 6 presents statistics on the rates, pricing, and structures of the bonds and the credit quality of the issuers. Panel A describes the total sample, and Panels B and C describe high-quality and low-quality issuers.

Of the 1,316 fixed-rate U.S. dollar-denominated global bonds rated, 87% (1,148 bonds) are high quality and the remainder are low quality. Note that our distinction between high- and low-quality is more severe than that commonly used in bank regulation; high-quality is Baa1 or BBB+ or better. Although most bank regulatory rules allow financial institutions to invest in securities rated as low as Baa3 or BBB-, many investors aim for slightly higher minimum credit quality to provide some flexibility should a bond be downgraded.

Spreads

The mean yield spread of a global bond above a U.S. Treasury note or bond of comparable term on the day of issuance is 128 basis points (87 basis point median). Given the AAA/Aaa rating of the United States for international debt, no other country or firm should be able to raise funds more cheaply for comparably structured debt.

The mean yield spread for high-quality bond issuers is 88 basis points (78 basis point median) versus a mean spread of 373 basis points for low-quality bond issuers (352 basis point median). Better-quality debtors are able to raise funds from the global debt market with less of a spread above the U.S. Treasury curve than low-quality entities.

Coupon

The mean coupon or rate attached to the fixed-rate U.S. dollar-denominated global bond averaged 698 basis points (675 basis point median). A higher coupon, ceteris paribus, leads to a lower effective duration, which reduces market risk exposure for the investor.

Coupons ranged from a mean of 662 basis points (656 basis point median) for high-quality debtors to a mean of 924 basis points (887 basis point median) for low-quality debtors.

Size

The average fixed-rate U.S. dollar-denominated global bond issued during this ten-year period was US$812 million (US $500 million median).

High-quality firms issue larger global bonds, with a US$919 million mean (US $500 million median), than low-quality debtors, with a US$570 million mean (US $500 million median).

Term and Duration

The average term to maturity of a fixed-rate U.S. dollar-denominated global bond is 12 years (9.75-year median). Interestingly, bonds issued by high-quality debtors average 11 years (7.6 years median), while the securities issued by low-quality debtors average 13.5 years (10 years median). Debtors with a lower-medium credit rating or a low-grade rating use the global bond to extend the maturity of their debt.

Although low-quality debtors issue longer-term debt than high-quality borrowers, the higher coupons paid by firms with higher default risk largely offset the term effect; the effective duration of debt ranges between 6.2 and 6.4 for all issuers. Consequently, a 1% change in the yield required in the secondary market for a global bond leads to approximately a 6% change in the value of the global bond for an average issue.

Fees and Managers

The gross fees paid by the borrower for the management, underwriting, and selling of a U.S. dollar-denominated fixed-rate global bond averaged 46 basis points (32 basis point median). High-quality debtors pay a lower fee (39 basis point mean) than low-quality borrowers (78 basis point mean).

Approximately 13 firms manage, underwrite, and sell a global bond. High-quality borrowers attract 14 firms to facilitate the issuance of a bond, while low-quality debtors average just 12 firms. Bonds issued by high-quality debtors are over 35% larger than the average bond issued by low-quality debtors; bond managers reduce their risk exposure by using more firms to underwrite and sell larger issues.

Ratings

The average credit rating of a fixed-rate U.S. dollar-denominated global bond is Aa3/AA- (Aaa/AAA median). (See the appendix for the numerical conversions for credit ratings.) The global bond market gives high-grade organizations an opportunity to raise large amounts domestically and internationally with one issue. The combined large size and strong credit quality are key factors in keeping the gross fees paid by debtors to less than one-half of 1% of a global bond.

The average credit rating for low-quality debtors is Ba1/BB+, just one notch below what global bank regulators consider as investment-grade. The average credit rating for high-quality debtors is between Aa2/AA and Aa1/AA+.

The global bond market is largely tapped by high-quality firms and organizations. Almost 80% of the bond sample is high-quality.

Approximately 90% of the fixed-rate U.S. dollar-denominated global bonds are rated for credit quality. Moody's Investors Service and Standard & Poor's attempt to determine the probability of default and the loss, given default, for nine out often global bonds brought to market during the initial sample period evaluated.

Registration

More than 98% of fixed-rate U.S. dollar-denominated global bonds are issued in registered form. Slightly more than 1% of the sample are sold in a bearer format. There is no statistical difference between high-quality and low-quality global bonds in registration structure. More than 3% of all global bonds issued in different currencies, with fixed or floating rate structures, are offered in bearer format, given historical European market custom.

Call Options

Approximately 6% of fixed-rate U.S. dollar-denominated global bonds include a call option. Although the call option is more common for U.S. dollar fixed-rate issues (given the longer average term to maturity of U.S. dollar-denominated debt), the difference is not significant (by a chi-square test at the 5% level of confidence). Almost 7% of high-quality,

fixed-rate, U.S. dollar-denominated bonds include a call option versus less than 2% for low-quality global debt; the difference is statistically significant (by a chi-square test at the 5% level).

## THEORETICAL PERSPECTIVE AND PRIOR RESEARCH

Public financial officers and private treasurers will select a global bond to raise funds if it is less costly to arrange than otherwise available, if the bond can be sold under more desirable terms and options than otherwise available, or if more funds can be obtained than otherwise possible. We evaluate the factors that most affect the yield spread when a global bond is first placed in the primary capital market.

The majority, of research has focused on absolute or relative yield spreads for corporate securities issued in domestic or international markets and for government securities issued in domestic markets. The literature provides a framework to judge empirical analysis of fixed-rate U.S. dollar-denominated global bonds during the first decade of their issue.

### Issue Size

How will the size of a fixed-rate U.S. dollar-denominated global bond affect the bond spread? Some consider the size of a bond a proxy for liquidity and marketability. If this is the case, larger bond issues should command lower relative yield spreads because more investors will be able to invest in and trade the bond. Broker/dealers will be able to achieve a given return on assets from a portfolio of such securities with a narrower bid-ask spread if the bonds trade more frequently.

Fisher (1959) and Lamy and Thompson (1988) support the marketability hypothesis. Booth (1992) in a study of bank loans between 1987 and 1989 finds that loan size is negatively related to loan spread.

Others believe the size of a bond leads to market congestion. If the global bond market is not deep, broad, or resilient, larger issues will require a market congestion premium to clear the market. Kidwell, Mart, and Thompson (1985) and Adedeji and McCosh (1995) support the market congestion premium.

Blackwell and Kidwell (1988) support a different argument, by finding no significant relationship between issue size and new issue yields. In a study of the relationship between liquidity and issue size of four corporate bonds and medium-term notes between 1987 and 1992, Crabbe and Turner (1995) find that yields are not affected by size, arguing that size may not be a good proxy for liquidity of a bond issue.

Thus the relationship between global bond size and yield spread may be positive or negative or insignificant, depending on the strength of the marketability versus market congestion impact. The lead global bond manager may offset the value at risk of selling a very large issue by making more comanagers responsible for evaluating, marketing, underwriting, and selling a bond.

### Maturity

How does the term to maturity of global bonds affect the yield spread? According to the liquidity preference hypothesis of the term structure of interest rates, longer-term bonds should require higher yields. Cox, Ingersoll, and Ross (1981), Sorensen (1979), and Fisher (1959) all derive positive relationships in their empirical analysis. The liquidity preference hypothesis posits that prices of long-term fixed-rate bonds are more volatile than prices of short-term fixed-rate bonds or floating-rate debt. Long-term fixed-rate bonds have a higher effective duration than shorter-term or floating-rate bonds. For a given change in interest rates, the prices of high-duration bonds are more sensitive or volatile than low-duration bonds.

Given the liquidity preference framework, interest rates on average must increase with maturity for fixed-rate bonds to compensate for incremental price or market risk. We should note that in our research this liquidity premium is a credit liquidity premium because we have already accounted for the term and duration of the bond in the yield spread. There is a greater chance a firm or sovereign will incur credit problems and

investors have less confidence of assessing credit quality farther into the future.

Johnson (1967) suggests that the relationship between maturity and yield should prove negative for low-grade issuers. Low-grade borrowers may experience a crisis at maturity for short-term bonds if there are concerns about the issuer's ability to refinance the bond or to obtain sufficient cash to repay principal at a quickly approaching maturity. Consequently, low-grade borrowers may be required to pay a higher yield to borrow short-term debt.

According to the conflicting arguments in the liquidity preference and crisis at maturity theories, the relationship between global maturity and yield spreads should prove positive with high-grade debt, but may be positive or negative for low-grade securities. Helwege and Turner (1999) also find that yield spread declines with maturity for speculative-grade bonds. They argue that long-term speculative-grade bonds are more creditworthy than short-term speculative-grade bonds for the same credit rating. We have noted that the average maturity of low-quality global bonds exceeds that of high-quality debt by over two years.

Credit Rating

Investors and other market participants rely on bond rating agencies to analyze information about companies, sovereigns, and bond issues to evaluate the uncertainty of repayment in a system of ratings. The capital markets seem to validate rating agency judgments by pricing lower-rated bonds at higher average yields.

For the U.S. markets, yields are generally related to credit ratings. In a study of corporate bond yields, Altman (1989) shows increased yields as the rating category drops. Cantor and Packer (1996) find the same pattern for sovereign bonds denominated in U.S. dollars.

Several other authors also use credit ratings to analyze the determinants of bond yields. Ederington, Yawitz, and Roberts (1987) and Moon and Stotsky (1993) find that credit ratings on corporate bonds and municipal bonds might incorporate information on default not available in the standard indicators of default risk. Artus, Garrigues, and Sassenou (1993), however, show in the French bond market either a weak or non-existent relationship between yield and the ratings of the largest French bond rating agency.

Registration

Bonds may be issued in bearer or registered form. Registered bonds require owners to file or register with the company or organization to receive **interest** and principal payments. A bearer **security** is payable to the physical holder or bearer of a security when the bond is presented for payment; no proof of ownership is required.

Registered bonds have largely replaced bearer bonds in developed countries such as the United States. Registration allows the government taxing agent to track interest income paid to investors and to ensure that income is taxed appropriately. Some investors will accept a lower yield on bearer form debt (or require a higher yield on registered debt) to evade income taxation. Registration reduces security issues related to fire or theft since ownership is electronic not physical.

As for the other financial issues, registration may lead to higher yields on global bonds if investors value the opportunity to take advantage of tax evasion or to lower yields if investors value safety of ownership and transfer. So far, there has been no empirical analysis of this issue.

Call Option

How will the presence of a call option affect the yield spread for a fixed-rate U.S. dollar-denominated global bond? Although a call option is not common in global issues (present in less than 7% of fixed-rate global bonds), a call provision allows a bank, company, or government organization to profitably refinance an outstanding high-coupon bond with a new lower-cost alternative if interest rates fall below the coupon of the initial debt instrument. Interest rates may decline for two reasons:

reduced market rates of interest in the United States, or improved credit risk ratings of the issuer.

A call feature exposes investors to several disadvantages. First, the cash flow of a callable bond is not known with certainty. Second, a callable bond will be called when interest rates have declined, which subjects an investor to reinvestment risk. Third, the price of a callable bond rarely appreciates by as much as a non-callable security, because the market anticipates that the callable bond will be redeemed at or near par if required yields decline.

The value of an option varies with the initial coupon of the global bond, the period-to-call, and the volatility of U.S. interest rates. Regardless of cause, a callable bond exposes investors to some additional risk; risk should be compensated by a higher yield premium.

Kidwell, Marr, and Thompson (1985) determine that the presence of a call option has had no effect on the yield spread of Eurodollar bonds issued by public utilities. Cook (1982), Ferri (1979), and Kidwell (1975), however, all determine that a call provision affects the yield spread for corporate or municipal bonds.

The call option should exert either no statistical effect on yield spreads if the call date is close to the maturity date or the option has little likelihood of being exercised, or a positive effect for fixed-rate U.S. dollar-denominated global bonds if the option has value.

YIELD SPREAD ANALYSIS

To assess the financial effect of bond structure, financial market activity, and issuer characteristics on the yield of fixed-rate U.S. dollar-denominated global bonds, we use a multiple linear regression testing framework that relates the yield spread to seven factors. We describe the research design and then present results for the complete sample and by bond quality.

Research Design

Yield spreads are normally measured two ways. An absolute yield spread (yield--index) represents the yield applicable to a fixed-rate global bond minus an index comparable to the term of a U.S. Treasury security when issued. To illustrate, if the fixed-rate yield on a dollar-denominated global bond issued by a private bank is 10% when the underlying yield on a comparable-term U.S. Treasury security at the time of primary market issue is 6%, the absolute yield spread is 4 percentage points (10%-6%), or 400 basis points.

The relative yield spread ((yield-index)/index) equals the absolute yield spread divided by the yield of a U.S. Treasury security with a term comparable to the global bond when issued. For a bond issued at 10% when the underlying index is 6%, the relative yield spread would be 66.7% ((10%-6%)/6%).

Either yield spread measure may be used to evaluate financial market performance of the bond. The relative yield spread is more appropriate in periods of volatile interest rates like the 1980s in the United States, and for bonds denominated in various currencies susceptible to widely different interest rates. The absolute yield spread is appropriate in evaluating bonds denominated in one currency for a relatively short period of time like this research sample of the first decade of the global bond market.

To determine why some fixed-rate U.S. dollar-denominated global bond issues are sold with a yield spread of only 10 basis points above a comparable-term U.S. Treasury security, while others require a 1,000 or more basis point margin or spread to clear the market, we use the specification:

(Ysprea.sub.i,t) = ((beta).sub.0) + ((beta).sub.1)((Size.sub.i,t)) + ((beta).sub.2)((Term.sub.i,t)) + ((beta).sub.3)((Rating.sub.i,t)) + ((beta).sub.4)((Reg.sub.i,t)) + ((beta).sub.5)((Call.sub.i,t)) + ((beta).sub.6)((Grfees.sub.i,t)) + ((beta).sub.7)((Mgers.sub.i,t)) + ((beta).sub.8)(Issr) + ((beta).sub.9)(Time) + ((epsilon).sub.i,t)

where i = the i-th issuer at time t;

Yspread = spread over yield to maturity on the issue minus the yield

to maturity on the U.S. Treasury issue of the same maturity on the day of issue, in percent;

Size = natural log of the issue size;

Term = term to maturity in years;

Rating = credit rating as the average of both Moody's and Standard & Poor's bond ratings at the time of issue; *

Reg = registration, a dummy variable taking the value of one if the issue is registered and zero otherwise;

Call = call option, a dummy variable taking the value of one if the issue is callable and zero otherwise,

Grfees = gross fees: total commissions for management, underwriting, and selling the issue paid by the borrower expressed as a percentage of the total amount of the bond;

Mgers = number of managers responsible for the bond issue;

Issr = issuer type for the full sample regression and issuer for the high-quality and low-quality samples; and

Time = month and year of issue.

Statistical Results

Exhibit 7 provides the regression results for the entire sample of fixed-rate U.S. dollar-denominated global bonds issued between 1989 and 2001 and for high-quality and low-quality subsamples. We assume the independent explanatory variables are not highly interrelated, and that error terms are spherical. When independent variables are dependent on one another, this multicollinearity may seriously limit inferences from the regression model.

Tests of partial correlation coefficients and variance inflation factors reveal few indicators of multicollinearity. Any variance inflation factors with a score above ten are either eliminated from the analysis or transformed into a logarithmic form rather than an absolute value.

We find evidence of both positive first-order auto-correlation using the Durbin-Watson statistic and heteroscedasticity in the error distribution using the Breuch-Pagan Lagrange multiplier test. We correct for these problems by estimating the models and reporting heteroscedasticity- and autocorrelation-consistent t-statistics using the approach suggested by Newey and West (1987).

Entire Sample. Six independent variables account for approximately 60% of the variation of global bond yield spreads, according to the adjusted R-square or coefficient of determination. Multiple regression model results are significant at the 1% level according to the F-statistic.

Four variables are significant at the 1% level: term to maturity, credit rating, registered structure, and call option. The variable gross fees paid the underwriters are significant at the 5% level. Issue size is significant at the 10% level. The number of managers variable is not statistically significant. Yield spreads increase with term to maturity, registration, call option, and gross fees. Yield spreads decline with issue size and credit rating.

The results for the entire sample support the liquidity premium term structure hypothesis, the credit liquidity premium hypothesis, the marketability liquidity hypothesis, the tax evasion registration argument, option pricing, and the presence of scale economies of size related to the issuance of global debt.

Firms or public organizations issuing global bonds with higher yield spreads also paid their underwriters higher fees. The higher yield spread compensates investors for higher risk due to credit quality, liquidity, or market risk factors; the higher fees provide the syndicate of managers and underwriters additional compensation for the risk of selling more risky bonds and for the additional time and resources required to sell more risky debt.

High-Quality Global Bonds. The regression model for the high-quality global debt issues exhibits an R-square of 59.54%, which suggests the regression equation is able to explain about 60% of the variation in bond spreads for high-quality fixed-rate U.S. dollar-denominated global bonds.

The F-value indicates the model is significant, which suggests that one or more explanatory factors have a significant linear relationship with the yield spread.

The yield spreads for high-quality global bonds are positively related at the 1% significance level to maturity, credit quality (inverted scale), and the call option. The gross fees paid and the number of managers involved in the primary issue are not significant. The yield spread is negatively related to issue size at the 10% level of significance.

The positive coefficient between yield spread and maturity is consistent with the liquidity preference hypothesis of the term structure of interest rates. Longer-maturity fixed-rate bonds exhibit more price volatility (i.e., have a higher effective duration) than shorter-maturity fixed-rate notes, and expose investors to a longer period of credit uncertainty. The potential price sensitivity of longer-term bonds requires a yield premium.

The negative coefficient between yield spread and issue size is consistent with the market liquidity hypothesis. Global bonds with a call option require higher spreads, consistent with option pricing theory. The registration variable is significant at the 1% level, supporting the tax evasion registration argument.

Low-Quality Global Bonds. The regression model exhibits a much higher R-square of 67.6% for fixed-rate U.S. dollar-denominated low-quality global bonds. The model explains approximately 68% of the yield spread for these global bonds. The F-value indicates the model is significant, and one or more variable has a significant linear relationship with yield spreads.

The results are different from those for higher-grade borrowers. First, maturity has no significant relationship with the yield spread. Longer-term issues do not necessarily require a higher yield as the liquidity premium hypothesis would predict. Lower-grade borrowers are more likely to experience a crisis at maturity. The perceived probability of default or loss, given **default**, increases as maturity shortens for lower-grade borrowers; the issuer must not only pay annual **interest** but must also repay principal more quickly with short-term notes. The crisis at maturity argument offsets the liquidity premium for low-quality global bonds.

Second, a call option does not impact yield spreads at the same significance as for high-quality borrowers. The credit risk premium required for low-quality bonds moves inversely with the general level of U.S. interest rates by a sufficient margin to reduce the expectation of a later successful call by low-quality debtors. In addition, under 2% of low-quality global bonds retain a call option.

Third, neither gross fees paid nor the number of managers has a significant effect on yield spreads for bonds of lower credit quality.

Only two factors--issue size and credit rating--significantly explain yield spreads for low-quality global bond issuers. The relationships for these two variables are similar to those in the entire sample and in the high-grade sample, but the two variables explain almost two-thirds of the yield spread variability for the low-quality sub-sample.

SUMMARY

Companies, banks, countries, and other entities borrow money for a variety of social and economic reasons, to include funding maturing debt, financing new projects, covering balance of payment deficits, and building reserves. The global bond has provided a new method of raising capital.

The typical global bond is a fixed-rate U.S. dollar-denominated medium-term **debt obligation** with an issue size of US$800 million underwritten by about 13 managers. Behind these averages are significant variations in bond structure, financing activity, and borrower characteristics. Some bonds pay a relatively high rate of interest in the primary market, while others require very little in the way of a spread over U.S. Treasury obligations.

Our evaluation of bond structure, financing activity, and issuer characteristics indicates most global bonds require issuers to pay a higher

yield spread to borrow longer-term funds. The findings are consistent with a term structure liquidity premium, not a crisis at maturity. Larger global bonds are issued with narrower yield spreads; this result is consistent with improved marketability, not a market congestion premium. Obviously, low-quality issuers must pay higher yield spreads than high-quality issuers, but low-quality bonds also require borrowers to pay their underwriting syndicate higher fees to market, underwrite, and sell their debt. Registered bonds require higher spreads than bearer bonds; this result is consistent with a tax evasion premium rather than a safety advantage.

The advantage of a global bond lies in the ability to raise a large amount of funds from one issue marketed and sold simultaneously in two or more geographic markets. Continued market acceptance will depend on investors' assessment of the risk and return relationship, and borrowers' ability to take financial advantage of more attractively priced key factors, such as issue size, credit rating, term to maturity, and embedded options, than are available in competing domestic or other international alternatives.

Given the rapid growth of the global bond in its first decade, it appears that both surplus investor and deficit borrower units increasingly believe the advantages outweigh the costs. Financial innovation prompts the competition and efficiency needed to support capital formation.

APPENDIX

Bond Rating Numerical Conversion

| Conversion Value | Moody s Rating | Standard & Poor s Rating |
|---|---|---|
| 22 | Aaa | AAA |
| 21 | Aa1 | AA+ |
| 20 | Aa2 | AA |
| 19 | Aa3 | AA- |
| 18 | A1 | A+ |
| 17 | A2 | A |
| 16 | A3 | A- |
| 15 | Baa1 | BBB+ |
| 14 | Baa2 | BBB |
| 13 | Baa3 | BBB- |
| 12 | Ba1 | BB+ |
| 11 | Ba2 | BB |
| 10 | Ba3 | BB- |
| 9 | B1 | B+ |
| 8 | B2 | B |
| 7 | B3 | B- |
| 6 | Caa1 | CCC+ |
| 5 | Caa2 | CCC |
| 4 | Caa3 | CCC- |
| 3 | Ca | CC |
| 2 | C | C |
| 1 | D | D |

EXHIBIT 1

Global Bonds by Year of Issue--October 4, 1989-March 28, 2001

| Year of Issue | Number of Issues | Percent | Issue Amount (Mil. US$) | Percent | Average Issue Amount (bil. US$) |
|---|---|---|---|---|---|
| 1989 | 1 | 0.04 | 1,500.00 | 0.08 | 1.50 |
| 1990 | 11 | 0.41 | 9,307.60 | 0.51 | 0.85 |
| 1991 | 62 | 2.29 | 15,514.88 | 0.86 | 0.25 |

| | | | | | |
|---|---|---|---|---|---|
| 1992 | 29 | 1.07 | 25,255.65 | 1.39 | 0.87 |
| 1993 | 42 | 1.55 | 41,203.70 | 2.27 | 0.98 |
| 1994 | 133 | 4.92 | 61,618.16 | 3.40 | 0.46 |
| 1995 | 133 | 4.92 | 69,487.54 | 3.84 | 0.52 |
| 1996 | 287 | 10.61 | 114,187.32 | 6.30 | 0.40 |
| 1997 | 453 | 16.75 | 122,145.03 | 6.74 | 0.27 |
| 1998 | 409 | 15.12 | 231,215.51 | 12.77 | 0.57 |
| 1999 | 546 | 20.18 | 405,492.26 | 22.39 | 0.74 |
| 2000 | 462 | 17.08 | 541,725.38 | 29.91 | 1.17 |
| 2001 | 137 | 5.06 | 172,652.51 | 9.53 | 1.26 |
| Total | 2705 | 100.00 | 1,811,305.54 | 100.00 | 0.67 |

Source: Euromoney Bondware.

EXHIBIT 2
Global Bonds by Currency of Issue--
October 4, 1989-March 28, 2001

| | Number | | Issue Amount | |
|---|---|---|---|---|
| | of Issues | Percent | (mil. US$) | Percent |
| Australian dollar | 18 | 0.67 | 5,225.16 | 0.29 |
| Canadian dollar | 76 | 2.81 | 25,528.29 | 1.41 |
| Czech koruna | 3 | 0.11 | 190.50 | 0.01 |
| Danish krone | 1 | 0.04 | 148.74 | 0.01 |
| Deutschemark | 23 | 0.85 | 19,086.06 | 1.05 |
| Greek drachma | 3 | 0.11 | 104.37 | 0.01 |
| Euro | 94 | 3.48 | 141,496.93 | 7.81 |
| French franc | 2 | 0.07 | 1,237.78 | 0.07 |
| Finnish markka | 1 | 0.04 | 347.46 | 0.02 |
| Hong Kong dollar | 5 | 0.18 | 406.39 | 0.02 |
| Italian lira | 3 | 0.11 | 1,289.36 | 0.07 |
| New Zealand dollar | 23 | 0.85 | 3,903.71 | 0.22 |
| Philippine peso | 2 | 0.07 | 250.74 | 0.01 |
| Polish zloty | 11 | 0.41 | 926.26 | 0.05 |
| South African rand | 9 | 0.33 | 220.00 | 0.01 |
| Russian ruble | 7 | 0.26 | 355.00 | 0.02 |
| Singapore dollar | 3 | 0.11 | 357.97 | 0.02 |
| Swedish krona | 3 | 0.11 | 677.05 | 0.04 |
| United Kingdom sterling | 34 | 1.26 | 12,437.08 | 0.69 |
| United States dollar | 2,329 | 86.10 | 1,561,310.34 | 86.20 |

| | | | | |
|---|---|---|---|---|
| Japanese yen | 55 | 2.03 | 35,806.35 | 1.98 |
| Total | 2,705 | 100.00 | 1,811,305.54 | 100.00 |

Source: Euromoney Bondware.

EXHIBIT 3
Global Bonds by Issue Type--October 4, 1989-March 28, 2001

| | Number of Issues | Percent | Issue Amount (mil. US$) | Percent |
|---|---|---|---|---|
| Convertible | 28 | 1.04 | 11,738.83 | 0.65 |
| **Floating**-rate **note** | 762 | 28.17 | 344,545.55 | 19.02 |
| **Floating**-rate **note** extendible | 3 | 0.11 | 3,819.00 | 0.21 |
| Fixed **rate** | 1,806 | 66.77 | 1,440,594.33 | 79.53 |
| Fixed **rate** with warrants for debt | 3 | 0.11 | 3,000.00 | 0.17 |
| Fixed **rate** with warrants for equity | 1 | 0.04 | 83.13 | 0.00 |
| Fixed-**rate** zero-coupon | 102 | 3.77 | 7,524.68 | 0.42 |
| Total | 2,705 | 100.00 | 1,811,305.53 | 100.00 |

Source: Euromoney Bondware.

EXHIBIT 4
Global Fixed-Rate Bonds by Currency of Issue Maturity--October 4, 1989-March 28, 2001

| | Number of Issues | Percent | Average Maturity In Years |
|---|---|---|---|
| Australian dollar | 17 | 0.94 | 7.20 |
| Canadian dollar | 33 | 1.83 | 10.83 |
| Czech koruna | 3 | 0.17 | 1.00 |
| Danish krone | 1 | 0.06 | 7.00 |
| German Deutsche mark | 17 | 0.94 | 7.86 |
| Greek drachma | 2 | 0.11 | 3.50 |

| | | | |
|---|---|---|---|
| Euro | 89 | 4.93 | 8.04 |
| French franc | 1 | 0.06 | 10.00 |
| Finnish markka | 1 | 0.06 | 5.00 |
| Hong Kong dollar | 5 | 0.28 | 7.40 |
| Italian lira | 1 | 0.06 | 20.00 |
| New Zealand dollar | 21 | 1.16 | 6.05 |
| Philippine peso | 2 | 0.11 | 5.00 |
| Polish zloty | 10 | 0.55 | 2.89 |
| South African rand | 2 | 0.11 | 18.83 |
| Russian ruble | 5 | 0.28 | 1.60 |
| Singapore dollar | 2 | 0.11 | 5.50 |
| Swedish krona | 3 | 0.17 | 7.44 |
| United Kingdom sterling | 33 | 1.83 | 12.54 |
| United States dollar | 1,507 | 83.44 | 12.18 |
| Japanese yen | 51 | 2.82 | 9.75 |
| Total | 1,806 | 100.00 | 11.59 |

| | Maximum Maturity | Minimum Maturity |
|---|---|---|
| Australian dollar | 15.00 | 2.00 |
| Canadian dollar | 30.00 | 3.17 |
| Czech koruna | 1.00 | 1.00 |
| Danish krone | 7.00 | 7.00 |
| German Deutsche mark | 10.00 | 4.67 |
| Greek drachma | 5.00 | 2.00 |
| Euro | 20.00 | 2.00 |
| French franc | 10.00 | 10.00 |
| Finnish markka | 5.00 | 5.00 |
| Hong Kong dollar | 10.00 | 5.00 |
| Italian lira | 20.00 | 20.00 |
| New Zealand dollar | 10.00 | 2.42 |
| Philippine peso | 5.00 | 5.00 |
| Polish zloty | 10.00 | 0.92 |
| South African rand | 27.67 | 10.00 |
| Russian ruble | 3.00 | 1.00 |
| Singapore dollar | 10.00 | 1.00 |
| Swedish krona | 10.00 | 5.00 |
| United Kingdom sterling | 30.17 | 1.17 |
| United States dollar | 104.00 | 0.75 |
| Japanese yen | 30.00 | 1.75 |
| Total | 104 | 0.75 |

Source: Euromoney Bondware.

EXHIBIT 5
Global Fixed-Rate Bonds by Issuer Type--October 4, 1989-March 28, 2001

| | Number of Issues | Percent | Issue Amount (mil. US$) | Percent |
|---|---|---|---|---|
| Central government | 143 | 7.92 | 126,137.74 | 8.76 |
| Local authority | 12 | 0.66 | 1,265.57 | 0.09 |
| Public bank | 38 | 2.10 | 39,203.19 | 2.72 |
| Public corporate | 4 | 0.22 | 1,050.00 | 0.07 |
| Public finance (other) | 330 | 18.27 | 564,712.10 | 39.20 |
| Public utility | 20 | 1.11 | 17,071.56 | 1.19 |
| State/provincial authority | 59 | 3.27 | 44,059.73 | 3.06 |
| Supranational institution | 128 | 7.09 | 90,215.26 | 6.26 |
| Private bank | 126 | 6.98 | 166,132.03 | 11.53 |
| Private corporate | 117 | 6.48 | 82,246.50 | 5.71 |

| | | | | |
|---|---|---|---|---|
| Private finance (other) | 809 | 44.80 | 282,311.26 | 19.60 |
| Private utility | 20 | 1.11 | 26,189.39 | 1.82 |
| Total | 1,806 | 100.00 | 1,440,594.33 | 100.00 |

Source: Euromoney Bondware.

EXHIBIT 6
Global U.S. Dollar Fixed-Rate Bonds--Sample Description

| Variable | Number | Mean | Median | Standard Dev |
|---|---|---|---|---|
| **Panel A: Total Sample of 1,469 Observations** | | | | |
| Spread (%) | 1469 | 1.28 | 0.87 | 1.55 |
| coupon (%) | 1469 | 6.98 | 6.75 | 1.36 |
| Size (mil. US$) | 1469 | 812.38 | 500.00 | 1,052.96 |
| Term (years) | 1469 | 12.07 | 9.75 | 10.33 |
| Duration | 1469 | 6.38 | 6.00 | 3.25 |
| Gross fees (%) | 1235 | 0.46 | 0.32 | 0.61 |
| Managers | 1469 | 12.79 | 10.00 | 9.84 |
| Rating | 1316 | 19.36 | 22.00 | 3.62 |
| Registration | 1469 | Registered (1,442 issues, 98.16%) | | |
| | | Bearer (18 issues, 1.23%) | | |
| | | Bearer and Registered (9 issues, 0.61%) | | |
| Call | 1469 | Callable (89 issues, 6.06%) | | |
| | | Non-Callable (1,380 issues, 93.94%) | | |
| **Panel B: High-Quality Issue Sample of 1,148 Observations** | | | | |
| Spread (%) | 1148 | 0.88 | 0.78 | 0.81 |
| Coupon (%) | 1148 | 6.62 | 6.56 | 0.92 |
| Size (mil. US$) | 1148 | 918.58 | 500.00 | 1,133.48 |
| Term (years) | 1148 | 11.13 | 7.58 | 9.73 |
| Duration | 1148 | 6.23 | 5.67 | 3.32 |
| Gross fees (%) | 962 | 0.39 | 0.30 | 0.51 |
| Managers | 1148 | 13.63 | 12.00 | 9.82 |
| Rating | 1148 | 20.47 | 22.00 | 2.20 |
| Registration | 1148 | Registered (1,126 issues, 98.08%) | | |
| | | Bearer (13 issues, 1.13%) | | |
| | | Bearer and Registered (9 issues, 0.78%) | | |
| Call | 1148 | Callable (77 issues, 6.71%) | | |
| | | Non-Callable (1,071 issues, 93.29%) | | |
| **Panel C: Low-Quality Issue Sample of 168 Observations** | | | | |
| Spread (%) | 168 | 3.73 | 3.52 | 1.97 |
| Coupon (%) | 168 | 9.24 | 8.87 | 1.74 |
| Size (mil. US$) | 168 | 570.02 | 500.00 | 581.96 |
| Term (years) | 168 | 13.51 | 10.00 | 9.11 |
| Duration | 168 | 6.19 | 6.00 | 2.11 |
| Gross fees (%) | 139 | 0.78 | 0.65 | 0.56 |
| Managers | 168 | 12.38 | 8.00 | 10.96 |
| Rating | 168 | 11.76 | 12.00 | 1.85 |
| Registration | 168 | Registered (166 issues, 98.81%) | | |
| | | Bearer (2 issues, 1.19%) | | |
| | | Bearer and Registered (0 issues, 0%) | | |
| Call | 168 | Callable (3 issues, 1.79%) | | |
| | | Non-Callable (165 issues, 98.21%) | | |

Source: Euromoney Bondware.

EXHIBIT 7

Regression Results for U.S. Dollar Fixed Rate Global Bond Yield Spreads

| Variable | Predicted Signs | Primary Specification | High-Quality Issues | Low-Quality Issues |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Intercept | | 6.5935 | 3.5898 | 16.2585 |
| | | (9.73) * | (13.62) * | (3.87) * |
| Issue size | +/- | -0.1078 | -0.0354 | -0.4852 |
| | | (-1.80) *** | (-1.65) *** | (-2.52) ** |
| Term to maturity | +/- | 0.0193 | 0.0232 | 0.0161 |
| | | (3.54) * | (5.11) * | (0.83) |
| Credit rating | - | -0.2560 | -0.1196 | -0.8644 |
| | | (-10.04) * | (-10.81) * | (-4.66) * |
| Registered | + | 0.6239 | 0.3730 | -1.1045 |
| | | (2.74) * | (3.61) * | (-1.26) |
| Call | + | 0.3575 | 0.4131 | 0.1185 |
| | | (3.87) * | (6.60) * | (0.13) |
| Gross fees | + | 0.2473 | 0.0549 | 0.4983 |
| | | (2.30) ** | (1.24) | (0.84) |
| Number of managers | - | -0.0054 | 0.0021 | 0.0046 |
| | | (-1.35) | (1.15) | (0.23) |
| Adj. R-Square | | 0.6014 | 0.5954 | 0.6758 |
| F-value | | 14.37 | 13.18 | 5.17 |
| Sample size | | 1469 | 1148 | 168 |

T-values in parentheses, computed using standard error with Newey-West correction for autocorrelation and heteroscedasticity with lag 1. *, **, and ***: significant at the 1%, 5%, and 10% level, respectively.

ENDNOTE

* Jewell and Livingston (1998) suggest that an average of Moody's and Standard & Poor's ratings provides the most efficient measure of default risk premium. Bond ratings are computed using a conversion process that assigns AAA-rated bonds a value of 22 and D-rated bonds a value of 1. For example, a issuer with an A1 from Moody's and an A+ from Standard & Poor's would receive an average score of 18.

REFERENCES

Adedeji, Abimbola, and Andrew M. McCosh. "Determinants of Eurobond Yields." Journal of Business Finance and Accounting, 22(8) (1995), pp. 1107-1124.

Altman, Edward I. "Measuring Corporate Bond Mortality and Performance." Journal of Finance, May 1989, pp. 631-640.

Artus, Patrick, R. Garrigues, and Mohamed Sassenou. "Interest Rate Cost and Issuer Ratings: The Case of French CP and Bonds." Journal of International Securities Markets, Autumn 1993, pp. 211-218.

BIS Quarterly Review, September 2001.

Blackwell, David W., and David S. Kidwell. "An Investigation of Cost Differences Between Public Sales and Private Placements of Debt." Journal of Financial Economics, 22 (1988), pp. 253-278.

Booth, James R. "Contract Costs, Bank Loans and the Cross-Monitoring Hypothesis." Journal of Financial Economics, 31 (1992), pp. 25-41.

Cantor, Richard, and Frank Packer. "Determinants and Impact of Sovereign Credit Ratings." FRBNY Economic Policy Review, October 1996, pp. 37-53.

Cook, Timothy, Q. "Determinants of Individual **Tax-Exempt Bond** Yields: A Survey of the Evidence." Economic Review, May/June 1982, pp. 14-40.

Cox, J.C., J. Ingersoll, and S.A. Ross. "A Re-examination of the Traditional Hypothesis about the Term Structure of Interest Rates." Journal of Finance, 36 (1981), pp. 769-799.

Crabbe, Leland E., and Christopher M. Turner. "Does the Liquidity of a Debt Issue Increase with its Size? Evidence from the Corporate and Medium-Term Note Markets." Journal of Finance, 50 (December 1995), pp. 1719-1734.

Ederington, Louis H., Jess B. Yawitz, and Brian E. Roberts. "The Information Content of Bond Rating." Journal of Financial Research, 10 (Fall 1987), pp. 211-238.

Ferri, Michael, and Gene Laber. "How Do Call Provisions Influence Bond Yields?" The Journal of Portfolio Management, Volume 5, Number 2 (1979), pp. 70-72.

Financial Market Trends, International Bond Markets. Various issues.

Fisher, Lawrence. "Determinants of Risk Premiums on Corporate Bonds." Journal of Political Economics, 67 (1959), pp. 212-237.

Helwege, Jean, and Christopher M. Turner. "The Slope of the Yield Curve for Speculative-Grade Issuers." Journal of Finance, 54 (October 1999), pp. 1869-1884.

Jankus, C. Jonathan. "Relating Global Bond Yields to Macroeconomic Forecasts." The Journal of Portfolio Management, Spring 1997.

Jewell, Jeff J., and Miles Livingston. "Split Ratings, Bond Yields, and Underwriters Spreads." Journal of Financial Research, 21 (Summer 1998), pp. 185-204.

Johnson, Ramon E. "Term Structure of Corporate Bond Yields as a Function of Risk of Default." Journal of Finance, 22 (1967), pp. 318-321.

Kidwell, David S. "Call Provisions and Their Effect on Municipal Bond Issues." Governmental Finance, August 1975, pp. 28-32.

Kidwell, David S., M. Wayne Marr, and G. Rodney Thompson. "Eurodollar Bonds: Alternative Financing for U.S. Companies." Financial Management, 14 (1985), pp. 18-27.

Lamy, Robert E., and G. Rodney Thompson. "Risk Premia and the Pricing of Primary Issue Bonds." Journal of Banking and Finance, 12 (1988), pp. 585-601.

Mohamed, Robert H. "Global Bonds Gain Momentum." International Law Review, March 1994.

Moon, C.G., and J.G. Stotsky. "Testing the Differences between the Determinants of Moody's and Standard & Poor's Ratings." Journal of Applied Econometrics, 8, 1 (1993), pp. 51-69.

Newey, Whitney K., and Kenneth D. West. "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." Econometrica, 55 (3) (1987), pp. 703-708.

Sorensen, Eric H. "The Impact of Underwriting Method and Bidder Competition upon Corporate Bond Interest Cost." Journal of Finance, 34 (1979), pp. 863-870.

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**Industry Codes/Names:** BANK Banking, Finance and Accounting; BUSN Any type of business
**Descriptors:** Bonds--Analysis; Debt--Analysis

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83/9/2 (Item 2 from file: 15)

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A glossary of derivatives market terms

**Anonymous**
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## Abstract:

A glossary of key derivatives market terms is presented.

## Text:

A

Absolute: Not relative to a reference rate or price.

/rate: A swap rate expressed as a percentage return, rather than as a premium/discount to a reference rate such as Libor.

/swap yield: The fixed-rate of an interest rate swap expressed as a percentage rate.

Accordion swap: See concertina swap.

Accreting: Literally 'growing', the notional principal amount of accreting instruments grows over their life according to a pre-set schedule or pre-defined index. Accreting instruments are useful for hedging liabilities expected to grow predictably, for example to hedge the step-by-step drawdown of a syndicated loan agreement. Hence one of its many other names, the drawdown swap. It is also known as the step-up swap. Accretion has been applied to caps, collars, floors and swaptions.

Accrual: The process whereby interest accumulates between payment or reset dates.

/swap: An interest rate swap under which a counterparty pays a vanilla floating reference rate, usually three- or six-month Libor, and receives Libor plus a significant spread. Interest payments to this counterparty will only accrue if rates stay within a certain range dictated by pre-set upper and lower boundaries. Libor is usually tested relative to the range daily, to give an averaging effect. A more aggressive variant, the binary (coupon) accrual swap, is also available. The difference is the some as the difference between corridor or range options and binary range options: in the binary version, any breach of the range boundaries means zero payment under the structure while in the standard version, boundary breaches only cancel that day's payment. Buying an accrual swap is physically equivalent to entering into a vanilla interest rate swap and writing a series of daily caps. More accurately though, the counterparty has bought a digital option with a payout equal to Libor plus the spread struck at the lower boundary value, sold another digital option with a payout equal to Libor plus the margin struck at the upper boundary level, sold another digital option with a payoff equal to the upper boundary rate minus the lower boundary rate

with the Strike set at the upper boundary, bought a conventional cap on Libor struck at the lower boundary and sold a conventional Libor cap struck at the upper boundary. Accrual swaps are a way of extracting value from FRA curves whose predictions of future **rates** the user does not believe. Also known as a fairway swap or range (Libor) swap.

/**note**: See range-**floating-rate notes**.

Adjustable strike options: Options whose strike price varies according to a predetermined underlying index. The commonest example is the adjustable strike cap (ASC). This is a cap whose strike price increases if the underlying (usually Libor) increases by more than a certain trigger amount in any one reset period. While rate rises stay below the trigger, the adjustable strike cap behaves like a vanilla cap. If rates rise faster than the trigger, then the amount of cap protection decreases. There is usually an absolute maximum strike rate. The holder of an adjustable strike cap is long a conventional cap and has sold a series of digital caps (or another adjustable strike cap with a maximum strike where the quarterly strike refers to the lost Libor setting).

In a positive yield curve environment, where the market is predicting rises near the trigger rate, the higher the possibility that the trigger will be breached and so the higher the value of this sold option. Hence the ASC is cheaper than a conventional cap. If the yield curve is negative, the ASC provides much less of a reduction in costs. The ASC can be made even less expensive by lowering the trigger, raising the strike adjustment that follows a trigger breach and by raising the maximum strike. Adjustable strike floors are also available. Also known as ratchet or momentum options/caps/floors.

Aggregation: The netting of positive and negative values of swaps affected by early termination allowed by some swap master agreements.

All-or-nothing option: A type of digital option which pays out a fixed amount if the underlying is above (call) or below (put) the strike on maturity.

Alternative currency option: An option on an asset denominated in a currency other than that in which the underlying is denominated. Sometimes also used as a term for dual currency options. See also currency protected option.

Alternative option: See rainbow option.

American-style: An American-style option can be exercised at any point during its life. In general, this makes such options more expensive than European-style options though this is most pronounced where the option's exercise results in the purchase of a position with better returns than the one liquidated to fund the purchase.

Amortizing: Used of derivatives whose notional principal decreases over the life of the instrument in accordance either wit a pre-set pattern or with an index of interest rates or mortgage prepayment rates. Instruments that have been structured in this way include caps, collars, floors, swaps and swaptions.

Analytic approximation models: The third main class of options pricing models. Analytic approximation involves estimating the premium for early exercise using a numerical technique and then adding this premium to the price of a European option obtained from an analytical model. The best known example of this type of model is the Barone-Adesi-Whaley model.

Analytical model: One of the three main classes of option pricing model (along with analytic approximation and numerical models) which like the Black-Scholes model and its later variants find an explicit solution to the problem of pricing a particular option or options using mathematical functions. Black-Scholes and others, for example, specify and solve a stochastic differential equation. While these models are simple, they cannot handle the early exercise feature of American-style options. This is because the decision to exercise before expiration depends on the behaviour of the price of the underlying security throughout the life of the option and cannot be reduced to a single parameter. They are also increasingly inaccurate as the term of the option lengthens because they cannot easily take into account variations in short-term interest rates or the time-dependence of volatility. The analytical solutions on which these models are based are also known as closed-form solutions and so the models are known as closed-form option pricing models.

Annuity swap: A type of amortizing swap in which an irregular payment stream is exchanged for a regular payment stream of the same present value. This is achieved by adjusting the swap's notional principal over its life.

Arbitrage: Instruments that have identical characteristics and so are perfect substitutes should trade at the same price. If they do not, a risk-free profit can be generated by simultaneously selling the higher-priced asset and buying the lower-priced asset. Arbitrage is the identification and exploitation of such price anomalies. For example, US government bonds are routinely stripped into their component parts, an interest-only strip and a principal-only strip. Theoretically, the price of the bond and the price of the two components combined should be identical. However supply and demand for the differing characteristics of the three instruments creates situations in which arbitrageurs can make money either by stripping bonds and selling the components or by recombining the components and selling them as complete bonds.

More generally the term arbitrage is used to mean profiting from differences in price between similar securities or packages of instruments or from trades which are undertaken when prices have moved from some historical or theoretical path or relationship in the expectation of a move back to the statistical norm.

Arbitrage-free model: A description of option pricing models that do not allow arbitrage of the underlying variable. Most commonly applied to models developed by Cox-Ingersoll-Ross, Ho-Lee, Heath-Jarrow-Morton and Hull-White. These were originally developed to price interest rate options and incorporate constraints on the movement of interest rates designed to avoid arbitrage possibilities caused by yield curve movements. The models differ essentially only in their assumptions about spot rate movements.

Arch: Acronym for autoregressive conditional heteroscedasticity, an econometric technique developed by Professor Robert Engle in 1982 to model random variables. It is an estimation procedure that allows a covariance matrix to change with time. It assumes that variance is stochastic and is a function of the variance of the previous time period and the absolute level of the underlying variable. Specifically, the conditional variance of a time series is allowed to depend on lagged squared residuals in an autoregressive manner. This means that during periods in which there are large unexpected shocks to the variable, its estimated variance will increase, and during periods of relative stability, its estimated variance will decrease.

Arch has found much favour in the options world as the basis for models which do not assume that volatility is constant. Most of the older option

pricing models do despite the evidence to the contrary. Instead, Arch-based models assume that volatility follows clear patterns; that today's depends on yesterday's and so historical volatility is a clue to future volatility and in particular that volatility should regress back to its long-term average. Several other variations exists, including Garch, AGarch, EGarch and QGarch.

Arithmetic Brownian motion: See Wiener process.

Arrears Rate Reset Swap: See Libor in arrears swap.

Asian option: See average rate option.
Asset swap: The application of an interest rate swap to the cash flows from an asset instead of a liability. Most commonly used when mispriced credit risk or other arbitrage opportunities between the swap and bond markets allow swap houses to take underpriced fixed-**rate** securities and create synthetic **floating-rate notes** paying a significant premium over Libor.

Assignment: Specifically in the option market, notice to an option writer that an option has been exercised. In the swap market, assignment is the transfer of a swap obligation to another counterparty.

Asymmetric payoff: The skewed profit pattern associated with options that gives profit sharing on the upside (appreciation for a call, depreciation for a put) while limiting liability on the downside. Contrast with the symmetrical payoff associated with forwards and futures.

As-you-like option: See chooser option.

Atlantic-style: See Bermudan-style.

At-the-money: The point at which an option's strike price and the price of the underlying asset are the same. Options can either be struck-at-the-money forward, in which case the strike price of the option is equal to the current implied forward price of the underlying or they can be struck at-the-money spot, in which case the strike is equal to the prevailing spot price of the underlying. For example, an interest rate cap struck at the current Libor level is at-the-money spot; one struck at the current swap rate for the period of the cap (or the FRA rate for a caplet) is at-the-money forward. Since derivatives are priced off the implied forward curve, there can be significant differences in the price of options on the same underlying struck in these two different ways. Foreign exchange options are almost always struck so that the forward outright is equal to the strike price.

Average rate option (ARO/AVRO) Unlike a conventional option, which is (cash) settled by comparing the strike with the spot rate at expiration, an average rate option is cash settled by comparing the strike with the average of a predetermined series of spot rates observed over the option period. This hedges against price movements without locking in a fixed price or rate upfront. The average can be geometric or arithmetic and can begin at any point during the option period. The sampling process -- frequency and interval of underlying price observations -- can be tailored. Unlike a straight American- or European-style option, an average rate option can be settled more than once over its life. So for example, the holder of a one-year average  rate option can choose to settle the option monthly versus the average price or rate of the underlying the previous month. Average rate options are cheaper than conventional options because the averaging process smooths out the underlying price movements thereby reducing volatility and hence the premium of the option. Typically the volatility of an average rate option is about half the volatility of a

conventional option. Also known as an average price (APO) or Asian option. Averaging has been applied to a wide range of swaps and options particularly in the commodity and foreign exchange markets. For example, an FX hedger short US dollar/long Deutschmark booked at 1.5700 could buy an ARO US$ call/DM put with a strike of 1.5700 and a fixing frequency of weekly every Friday for three months (12 fixings). With the forward at 1.5673 and 9.8% volatility the premium cost would be 1.15% US$ as opposed to the 1.83% US$ of a conventional European-style option. If the average were above 1.5700 on expiry, the underlying would be hedged at an effective rate of 1.58805. If the average were below 1.5700, then the underlying benefits below an average rate of 1.55195. It should be noted that AROs are cash-settled, not deliverable, so when hedging an underlying exposure, cash flows need to be converted in the underlying market on the relevant fixing dates. This ensures that the hedge instrument effectively offsets the aggregate FX rate of the cashflow conversions.

Average strike (rate) option: A type of moving or floating strike option in which the payoff is determined by comparing the underlying price at expiration with a strike computed as the average of a pre-determined series of spot rates over the lifetime of the option. The option is then exercised against the spot rate prevailing at expiry and can be either cash or physically settled. Since the option strike is uncertain and not determinable until exercise, this type of option is less expensive than a standard option. An example of its use would be a company with reasonably forecast random periodic receipts in a local currency followed by a single aggregate disbursement in a foreign currency. An average strike rate call on the foreign currency would preserve the relative foreign exchange rate between receipts and disbursements without forgoing the opportunity to gain on the disbursement.

B

B-cap: The B(ounded Q)-cap is the combination of a long Q-cap and a short Q-floor and provides the holder with a guaranteed maximum and minimum price for the underlying -- usually interest costs. It differs from a standard collar in that the actual amount of interest to be paid is collared, not the interest rate. See Q-cap.

B-floor: The bounded-Q floor is the combination of a long Q-floor position and a short Q-cap position and guarantees a minimum and maximum amount of interest income in return for a premium. The product suits risk-averse investors. See Q-floor.

Back contract: The most distant futures contract available.

Back end set swap: See Libor-in-arrears swap.
Back month: Any futures contract maturity beyond the nearest month expiry.

Back spread: (i) Any complex option position where more options are purchased than sold. (ii) A complex option position whose value will rise given a sharp movement up or down in the price of the underlying. (iii) Also used of spread positions in which the holder receives premium upfront.

Back-to-back swap: A swap agreement executed against an existing swap position that reverses the cash flows of the counterparties to it.

Backwardation: Primarily used of commodity markets, the situation in which futures prices are lower than spot prices to produce a negatively sloped forward curve. Originally used of a situation in which two sets of bid/offer prices on the same instrument are such that a third party can make a riskless profit by buying at one offer and selling at the other bid. See contango.

/swap: A commodity swap under which counterparties exchange a payment stream based on the nearby futures contract for one based on a more distant futures contract plus a spread. A commodity consumer could use such a swap to fix the spread differential between spot and forward prices to offset the costs they would incur if the spread relationship reversed, for example if absolute prices fell. Under this type of swap the consumer might pay the average daily price of the nearby futures contract and receives the six-month or 12-month contract plus a spread. If the curve flattens, the profit on the swap offsets the higher cost of hedging new forward purchases. See commodity swap, contango, contango swap.

Balloon option: An option whose notional principal increases if a pre-set trigger level is breached. For example, an equity investor might believe that the FTSE-100 will rise from 3000 to 3100, and then, if it breaches this resistance level, rise strongly again. He could buy a 3000 call with a trigger of 3100 and a multiple of two, meaning that if the index stays below 3100, the option behaves like a vanilla call but if it rises above 3100, then the option notional doubles. The balloon option is more expensive on the original notional principal than a vanilla option because it is the combination of two options -- a vanilla call struck at 3000 and a knock-in call struck at 3100. However, if the trigger is reached, the premium on the ballooned notional is cheaper. The greater the ballooning the higher the premium; the further the trigger level is out of the money, the cheaper the premium. See double-up swap.

Barone-Adesi-Whaley: An analytic approximation option pricing model devised in 1987 by Giovanni Barone-Adesi and Robert Whaley which incorporated a quadratic approximation approach into a particularly accurate model valuing American-style calls and puts on assets which pay continuous dividends.

Barrier: The price or rate at which certain types of derivative are activated or deactivated.

/option: A class of path-dependent options which extinguish or come alive when predetermined trigger points are reached. There are two types, (knock)-in options, which are activated when the pre-set barrier price is reached by the underlying and (knock)-out options, which are extinguished when the barrier price is reached. These fall into two further groups: standard knock-out and knock-in options and reverse knock-outs and knock-ins. Standard knock-outs/ins are activated or terminated as the option is moving out-of-the-money. So the barrier level would be below the spot rate for a call (down-and-in/out calls) and above the spot rate for a put (up-and-in/out puts).

Reverse or in-the-money knock-outs/ins are activated or terminated as the option moves into the money. So, the barrier level would be above the spot rate for a call (up-and-in/out calls) and below the spot rate for a put (down-and-in/out puts). These are priced and behave very differently from standard barrier options. Other more exotic varieties are available which knock-in or out only after the barrier has been breached more than once and knock-out options can be structured to pay a pre-set fixed amount if they are knocked out (known as knock-out with rebate options.) Knock-out options are sometimes termed 'clever' or 'intelligent' because they disappear when they are no longer needed though this is not true in the case, for example, of a down-and-out put. Barrier options cost less than standard European options. How much less depends on how near the spot/forward level the extinguishing level is and on the maturity of the option. It will be much cheaper for on up-and-out call and down-and-out put if the trigger is set near spot/forward and vice versa for a down-and-in put and up-and-in call. This is easiest to understand in the context of standard barrier options. For these options, the premium reduction over vanilla options is a function

of the trigger level. The more likely the option contract is to be knocked out or the less likely it is to be knocked-in, the greater the premium reduction, and vice versa. The price reduction is also highly sensitive to volatility: the higher volatility, the more likely the knock-out are to be reached and so the lower the price but the more likely knock-ins are to be activated so the higher the price.

Knock-outs are the commonest barrier options and were first developed for equity investors to reduce the price of collars on stock indices, calls on stock indices and also as a way of creating cheap and 'intelligent' positions such as the down-and-in call. They are now also used by corporate treasurers in both their foreign exchange hedging (see box) and in interest rate hedging.

For example, a German proper developer with DM100 million in three-year floating rate loans wants protection against interest rates rises. The company believes that rates will not rise much but needs catastrophe insurance. A straight cap at 8% -- the company's breakeven -- costs 250 bp. The company believes that the probability that German rates will hit 10% is very remote and that even if they rose that for it would only be for one cap period. They buy a three-year 8% cap with a knock-out at 10% for 110 bp. Combinations of barrier options and of barrier options with standard options can be used to create synthetic barrier or standard payoffs. For example, a position consisting of a down-and-out and down-and-in option with the same triggers has the same payoff as a standard option. Also known as trigger options. See also hybrid derivative for knock-in caps and floors and delta positive for delta behaviour.

/price: The price at which a barrier option is activated or deactivated. In a knock-out, the barrier price is called the outstrike; in a knock-in, the instrike.

Basis: (i) In futures markets, the price of the futures contract minus the spot price. That is, the difference between the forward price/yield and spot price/yield of futures (and also options). Basis is divided into carry basis and value or excess basis. Carry basis is the theoretical price of the future, minus the spot price of the underlying asset, and is equal to the net cost of carry, which may be positive or negative. Value or excess basis is the difference between the theoretical price of the future and its market price.

(ii) More generally, the relationship between prices/yields in related markets

(iii) The basis upon which interest rates are calculated for bond and money market instruments.

/risk: The risk that prices in the underlying market are not exactly correlated with prices in the futures market. Consequently basis risk is used more generally of the risk that hedges composed of offsetting positions in the cash and derivatives markets become unbalanced.

/trading: Trading the spread between the futures (or more generally derivatives) markets and the underlying cash market.

/swap: A floating-floating interest rate swap under which floating payment streams referenced to different indices are swapped. Basis swaps arose from banks' needs to hedge the spread exposure between different short-rates, for example lending at prime and funding in Libor. Hence the commonest are US Prime for Libor, CP for Libor, T-bill for Libor or six-month Libor for six-month Libor reset monthly, and hence the alternative name for a basis swap, money market swap. They are also very common in commodity markets

where they are used to hedge fluctuations on spreads between different products.

Basket: A selection of stocks, indices, commodities, currencies or interest rates which can either be traded as a unit themselves or which can be used as the underlying for a derivative product.

/options: Options whose payout is related to the cumulative performance of a basket of products. The main drawback of basket options when used as hedges is that they quickly become out of date if the underlying portfolio is highly variable. See currency basket option, interest rate basket option.

/warrant: A securitized basket option.

Bear spread: A position involving the simultaneous sale and purchase of options which benefits from falling prices in the underlying and in which the upside profit is limited and downside risk limited to the net premium paid upfront. A bear call spread is the purchase of a call option with a high exercise price and sale of another with a lower exercise price, both generally with the same expiration. A bear put spread is the purchase of a put option with a high exercise price and sale of another with a lower exercise price, both generally with the same expiration.

Bermudan-style: An option that can be exercised on a number of predetermined occasions. Also known as limited-exercise, quasi-American or Atlantic-style options (because they are half-way between American- and European-styles).
Beta (B): A measure of the sensitivity of an asset's return to an underlying factor or index. Most commonly used to refer to market beta where the underlying factor is the market. So, since the market's beta is one, returns on a security with a beta of one will move in line with the market; if beta is greater than one the security will exaggerate market returns; if it is less than one it will under-reflect market moves; and if beta is negative, security and market returns move in opposite directions.

Better of x assets option: See rainbow option.

Binary: In derivatives, applied to any structure whose fixed payout is either made ('on') or not made ('off') depending on the level of the underlying.

/option: See digital option.

/coupon accrual swap: See accrual swap.

/range **floater**: See range **floating rate note**.

Binomial: In derivatives applied to processes which model the underlying in terms of movements in one of only two possible directions at each point at which it is allowed to move.
/distribution: The most important discrete probability distribution options pricing. (Discrete probability distributions are those in which the underlying variable can only have certain discrete values. Most option pricing models assume continuous probability distributions such as lognormal and normal distributions.) To satisfy a binomial distribution a discrete random variable must satisfy four conditions: only two possible values can be taken on by the variable in a given time period (known as a binomial trial); for each of a succession of trials the probability of each of the two outcomes must be the same; each trial is identical; each trial is independent.

/option pricing model: An option pricing model which uses binomial trees to model the price of the underlying. This is the most common type of numerical model. The key to the binomial or lattice-based model is the division of the time to expiry of the option into discrete intervals or steps. At each step the model assumes that the key parameter, typically the price or yield of a security, evolves through time on a step-by-step basis moving either up or down by a fixed proportion in each interval. (A trinomial tree would allow three possible movements, and a multinomial model more than that). By working backward through the lattice from expiration, at which time the value of the option is known, options can be evaluated by discounting the terminal payoff through the tree: the value of the option is that which avoids an arbitrage profit. The advantage of binomial models is that they can deal with a range of different assets, options or market conditions. So, a lattice-based model gives rise to an algorithm rather than a closed formula for determining the option value. Such models are particularly useful for valuing American-style options and interest rate options. The best-known is the Cox-Ross-Rubenstein model.

/tree: The series of values generated by the binomial trial process. The binomial/lattice approach divides the time until option maturity into discrete intervals and presumes that during each of these intervals the price of the asset follows a binomial process moving from its initial value S, either up to value Su with probability p or down to value Sd with probability 1 minus p. Representations of the resulting distribution resemble trees or lattices. The binomial process is usually specified as being path-independent -- that is, a move up followed by a move down results in the same price as a move down followed by a move up so that the branches recombine. This specification is an assumption that the underlying is normally distributed. Trees that do not incorporate this feature are said to be non-recombining, bushy or exploding. They are much more computationally demanding.

Black-Derman-Toy: A single-factor (in this case short-term interest rates) term structure option pricing model proposed by Fisher Black, Emanuel Derman and William Toy in 1990 which expanded on the Ho-Lee model by specifying a time-varying structure for volatility and incorporating it into a binomial tree of possible forward short rates.
Black-Scholes model: Developed by Fischer Black and Myron Scholes in 1973, this is the classic modern option pricing model and the first general equilibrium solution for the valuation of options. The model provides a no-arbitrage value for European-style call options on shares as a function of the share price, the exercise price of the option, the risk-free interest rate and the variance of the stock price which is assumed to follow a lognormal distribution.

It does this by recognizing that stocks and calls on them can be combined to construct a risk-free portfolio and that options on equities can therefore be valued using a dynamic hedging argument. That is, the option writer can exactly offset his exposure to the underlying stock by continuously buying or selling it. The model shows that, by combining the underlying stock and a money market instrument, a riskless hedge (the delta hedge) can always be formed that exactly replicates the payoff of the option to be hedged. This means that a portfolio formed by the combination of the option and its riskless hedge must appreciate at the risk-free interest rate.

This riskless hedge method circumvents the difficulties of specifying investors' risk preference and allows the risk-free interest rate to be used in the valuation process rather than some other discount rate that reflects the appropriate risk level. For any time period, the value of such a portfolio can be computed as its value at the end of the period

discounted back one period at the risk-free rate. Because the price of an option is a deterministic function of the price of the underlying asset at that time, given that the distribution of asset prices is known for each time period (and in this model it is assumed to be lognormal), then the initial value of the option can be deduced by working backwards in time.

The model's great achievement is completeness: it provides a method for hedging options with the underlying asset, which allows for arbitrage pricing and hedging. Its drawbacks are that it assumes no dividends, no taxes or transaction costs, constant short-term interest rates, no penalties for short sales, that volatility and interest rates are constant, that the market operates continuously and that stock price distribution is lognormal. The generalizations of Black-Scholes address these problems, while extensions to it apply it in a modified form to options on futures, options on currencies and to exotic options.

The basic model has problems pricing short-dated options because volatility is not time-homogenous and long-dated options because it fails to take into account mean reversion. It systematically undervalues near-maturity options, deeply out-of-the-money options, options on low volatility stocks and overvalues long-term options, deeply in-the-money options and options on high volatility stocks. All these problems are due to the model's assumption of the uniformity of variance across time. Other types of models address these problems. See binomial model, CEV model.
Blended interest rate swap: A swap in which the swap buyer pays a mixture of fixed- and floating-rate interest on the notional principal. The fixed- and floating rate levels are set at the outset of the swap, while the percentage of the notional principal to which the floating rate is applied depends on the level of interest rates. For example, one counterparty might receive dollar Libor and pay an off-market low fixed rate fixed for a two-year protection period. After that period, he pays a blended rate of that fixed rate plus dollar Libor, plus or minus a spread. The percentage of Libor in the blend increases with Libor according to a predetermined table of trigger levels. The counterparty pays floating on a greater proportion of the notional principal if Libor rises. Also known as an incremental floating swap, self regulating swap.

These swaps can also be tailored so that it is the fixed rate portion of the swap that increases with Libor -- see under incremental fixed swap. Also see index amortizing swap, index principal swap, Libor regulating swap, semi-fixed swap.

Bond index: A measure of the returns from a standard or customized basket of bonds.

/note: A note whose coupon or principal payments are tied to a standard or tailored bond index. These notes are often cross-credit structures. For example, a double-AA issuer might issue a bond linked to a basket of junk bonds, thus allowing an investor not otherwise allowed to invest in high yield markets to gain exposure to them. The effect of notes being up- or downgraded out of the underlying index should be studied carefully before entering into this type of investment as this can cause the index to behave differently to a real basket of the underlying bonds.

/swap: A type of interest rate basis swap in which the returns from a bond market or segment of a bond market are exchanged for a money market reference rate plus or minus a spread. For example, the returns from the JP Morgan world government bond index might be swapped for three-month Libor minus 100 basis points. In one form, bond index swaps are a type of credit derivative. In such cases the returns from one portfolio or index of bonds are swapped for the returns from another portfolio or index of bonds of a different credit quality. For example, the yields on the triple-A subset of

the Salomon Brothers Eurodollar bond index could be paid in exchange for the (higher) yields on the single-A sub-index with the single-A receiver taking on the credit risk that he will receive the debt of any defaulting issuer within that sub-index.

Boundary binary option: The combination of a range binary option with a limit binary option. The holder of this position receives a fixed multiple of the premium paid either if the underlying (usually an exchange rate) stays inside a predetermined range or if it hits both extremes of the range. If it only hits one boundary the premium is lost and the structure is terminated. It takes the view that volatility will either be low, or high, but that no strong directional trend will emerge during the option's life.

Box (spread): The combination of a horizontal or calendar call spread and a calendar put spread with both spreads having the same expiration dates on their long and short positions. Such positions, commonest in the equity options market, are designed to capture the value in mispriced options while hedging against market risk or, alternatively, are used to tie up or free up cash. More generally the term box position refers to any offsetting spread positions; for example, the combination of bull and bear spreads.

Break forward: The sale of an off-market forward at a sufficient discount to the prevailing forward rate that the present value of the discount pays for an option to cancel the forward agreement at a predetermined strike price. Commonest in the FX markets. So, for example, with the standard forward contract rate at $1.50, a dollar/sterling break forward with a contract rate of $1.55 might permit the holder to break -- unwind -- the forward contract at a price of $1.50. The payoff of this modified forward is that of a long call on sterling struck at $1.50. If the dollar value of sterling rises, at expiration the hedger will obtain the then prevailing spot minus $1.55. But if the value of sterling declines, the holder of the break forward will unwind the contract at $1.50. The $0.05 difference in rates for the standard forward contract versus the break forward represents the implicit premium paid for the option structure. Break forwards are typically executed so as to be zero premium and are a way of obtaining an option-like exposure without paying a premium. They were also accounting driven since, until early 1992, they could be accounted for as forwards (to which hedge accounting was applied so that gains or losses on the transaction could be deferred until the hedged transaction was recognized) while written options would have to be marked-to-market.

Brownian motion: The archetypal random motion observed by botanist Robert Brown in 1828 of pollen grains in water. Variants of this are used as the assumed path of securities prices in many financial models.

Bull spread: A position involving the simultaneous sale and purchase of options which benefits from rising prices in the underlying and in which the upside profit is capped and downside risk is limited to the net premium paid upfront. A bull call spread is the sale of a call option with a high exercise price and the purchase of one with a low exercise price, both generally with the same expiration. A bull put spread is the sole of a put option with a high exercise price and the purchase of one with a low exercise price, both generally with the same expiration. These can also be considered to be volatility trades since purchasers of call spreads will benefit if volatility rises and sellers of put spreads will benefit if it decreases.
/warrants: A warrant whose payoff mimics that of a bull call spread.

Butterfly (spread): A combination of four options. Used to describe a number of complex options positions, usually either the combination of a bull with a bear spread, or of an at-the-money straddle with an

out-of-the-money strangle. So, a long butterfly might be long an option (put or call) at 40, short two at 60 and long one at 80. The characteristic shared by all the combinations is that the holder benefits from stable prices in the underlying while remaining protected against large movements in underlying prices.

Buying the basis: See cash-and-carry trade.

Buy-write: See covered call.

C

Calendar spread: The simultaneous sale of an option with a nearby expiry date and the purchase of an option with a later expiry date, both with the same exercise price. See diagonal, horizontal and vertical spreads.

Cancelable swap: See callable swap.

Callable: Terminatable early. Usually of bonds whose issuers can redeem them at pre-set dates.

/fixed floater: An FRN that pays a high floating rate for, say, the first year, at which point it is callable. If it is not called, the investor then receives a fixed rate coupon. The investor is effectively long an FRN and short a cap. The higher yield paid by the bonds reflects the premium received by the investor for the sale of the cap.

/swap: An interest rate swap in which either the fixed-rate payer or the fixed-rate receiver has the right to terminate the swap at one or more predetermined points during its life. These points are either defined in terms of time or in terms of points on the swap curve. So, for example, a treasurer paying fixed and receiving floating under a swap might like to cancel the swap if rates decline. A cancelable swap gives him to option to stop paying fixed (and so effectively to start paying floating) and he pays for this option by paying a fixed rate on the cancelable swap that is higher than prevailing vanilla swap rates. The counterparty with the right to terminate has effectively bought a swaption from the other counterparty which protects them against adverse moves in interest rates. In this case the treasurer has bought a receiver swaption. Most usually, a callable swap is one in which the fixed-rate payer has the right to terminate the swap, that is has bought the call. A swap in which the fixed-rate receiver has the right to terminate, that is has bought a put, is known as puttable.
Call option: An option that grants the holder the right but not the obligation to buy the underlying at a predetermined price. The buyer of a call is expressing a bullish view of the underlying and also implicitly, since he is long an option, believes either that volatility will rise or at least that it will not fall.

/monetization: Realizing the value of the call options embedded in some fixed-rate and many floating-rate bonds. It can be effected using forward swaps or selling call options on government bonds but is usually achieved by selling a swaption with a notional principal equal to the bond principal, an exercise date equal to the call date of the bond and with the underlying swap maturity equal to the maturity date of the bond.

Call spread: The simultaneous purchase and sale of equal numbers of call options with different strike prices but the same expiry date. See bear spread, bull spread.

Cancelable forward: See break forward.

Cap: An option strategy that sets a ceiling on the holder's interest rate

exposure. A cap takes the form of an agreement under which, in exchange for a one-time upfront premium payment, the seller agrees to pay the buyer the difference (if positive) between the strike **rate** and the current **rate** at pre-set times over the life of the cap thus establishing a maximum interest **rate** for the holder. **Note**: a cap is not a continuous **rate** guarantee; claims can only be made on specified settlement dates. This makes it best suited to capping the interest **rate** on **floating-rate** loans that are reset periodically.

The buyer selects the maturity, interest rate strike level, reference floating rate, reset period and notional principal amount. A cap can be constructed either from a series of single-period calls on an interest rate index or from a series of puts on an interest futures contract or zero coupon bond. Caps are priced off the implied forward curve -- the relevant implied forwards being either the swap rate for the period of the cap or the FRA rate for a caplet. The simplest approach to pricing caps assumes that forward interest rates are lognormally distributed. Also known as a ceiling rate agreement.

/rate: The strike price or rate of a cap.

Capitalized option: See contingent premium option.

Caplet: The name given to one of the series of single-period options from which a cap is constructed. Also known as single period caps.

Capped: The maximum payout of capped options, warrants and the maximum floating-rate payable/receivable on a swap is capped if it is limited either by a pre-set cap level or, in the case of options, by automatic exercise of the option when the underlying reaches a pre-determined point. See exploding option.

/**floating rate note**: An FRN whose maximum coupon is capped. Investors have bought an FRN and sold a cap. They are therefore taking the view that **rates** will not rise above the cap strike, in turn a bet that rates will not move as high as the implied forward curve suggests. The benefitS will be greatest when the cap is at its most expensive -- that is, when volatility is high and the curve is steeply positive. The notes have non-standard duration and volatility risk characteristics.

Capped, floored, capped and floored and collared FRNs are generally bets against the high predicted forward rates occurring. That is, they contain views that run contrary to forward rate predictions contained in the implied forward curve. It is therefore inappropriate to analyze these structures using forward analysis.

Caption: The option to buy or sell a cap.

Carry: The difference between the benefits and costs of maintaining a position in the cash market.
Cash-and-carry arbitrage: A basis trade involving a long cash position exactly offset by a short futures position. The holder of the position believes that the futures contract is expensive. He shorts the future, borrows at money market rates to finance a long position in the underlying and either delivers the asset into the futures contract or waits for a narrowing of the basis and closes out the positions, in which case he effectively collects the yield on a synthetic money market instrument. Also called buying the basis. This arbitrage and its opposite, reverse cash-and-carry, ensure that cash and derivatives markets do not diverge too far.

Cash settlement: The closing of a derivatives position by marking it to market and settling outstanding obligations in cash instead of by physical delivery of the underlying asset. Most financial derivatives and almost all over-the-counter derivatives are settled in this way.

Ceiling rate agreement: See cap.

CEV-option pricing model: CEV, or constant elasticity of variance, is an assumption made by some option pricing models, notably the Cox-Ross model, to accommodate empirical observations of volatility. The assumption is of an inverse relationship between the variance and price of the underlying. The variance referred to is usually that of the natural logarithm of the asset price relatives. These are assumed by many pricing models to be normally distributed with a variance that is proportional to the time over which the price change takes place. This implies that volatility will increase indefinitely as the time period to which the volatility relates is increased. This is not so.

Chooser option: A compound option that is neither a call nor put until, at a pre-determined date known as the choose or choice date, the holder of the chooser may trade it in for either a call or a put on the previously chosen underlying. If the call and the put have identical strikes and expiry dates, the option is a regular chooser and can be priced via on analytical model. If they differ in strike or expiry, they are termed complex choosers, which can only be priced using a numerical model. A chooser is similar to a European-Style straddle (simultaneous purchase of put and call) but, since the holder must choose between one or the other at some point, it is cheaper. It suits aggressive investors who wish to take a view on volatility.

The pricing relies on put-call parity and the fact that the option writer knows that the option holder will always choose the more valuable option on the choose date. In other words, if the call is more valuable than a put of the same tenor, the chooser holder will choose the call. If the put is the more valuable, the holder of the chooser will choose it, exercise it and create a synthetic put by shorting the underlying and rolling the position forward at the strike price. Also known as a double option or a preference option.

Circus option: See cross-currency swaption.

Circus swap: Currency swap in  which one leg is fixed and the other is based on a floating index, usually US dollar Libor. Supposedly an acronym from combined currency and interest rate swap.

Clean index principal swap: The clean index principal swap is a path-dependent version of the normal index principal swap. In the latter, the principal can accrete or amortize, and once the process of accretion or amortization has started it either continues at the level set by the initial barrier or is accelerated as rates move to the next barrier. In the clean index principal swap, the swap notional is reset according to the Libor rate prevailing at the beginning of each calculation period. It is clean in the sense that for each calculation period the swap notional is totally independent of previous settings. This means that the swap's notional amount is far more directly linked to the direction of Libor than is the case for a generic index principal swap.

So, for example, say a corporate decides to pay fixed and receive six-month Libor and the amortization factors are set such that, if Libor is below 5.0%, the notional principal on the swap is zero. This means that if Libor is below 5.0% at the beginning of a calculation period, then for that

period the hedger simply pays Libor -- the swap is deactivated. The higher Libor rises, the more of the hedger's outstanding liability is swapped into fixed until, at a predetermined point, the full liability is capped at the fixed rate payable on the swap. The product allows clients to fix without being affected by the cost of carry associated with a steep yield curve. In exchange for this, before the swap is fully activated the corporate pays a blended rate made up of Libor on the unswapped portion of the liability plus an above-market fixed rate on the remainder.

Cliquet option: A French name applied to a variety of options which lock-in or reset strike levels at predetermined points in a ratchet-like manner (vilbrequin a cliquet is French for ratchet brace) or which are automatically exercised or altered if the underlying reaches a pre-determined level (cliqueter is French for to knock and this automatic exercise is often called the cliquet clause). See ladder option, capped options, exploding option, barrier option.

Closed form solution: See analytical solution.

CMO swap: Collateralized mortgage obligations (CMOs) are securities whose repayment of interest and principal is backed by a pool of mortgages. A CMO swap is a type of mortgage replication swap, themselves a form of amortizing swap, whose notional principal reduces according to the repayment rate of a specified pool of mortgages or according to the prepayment rate of a CMO tranche.

Cocktail swap: Term once used to describe any complex swap.

COFI: The 11th District Cost of Funds Index, a US interest rate index important to savings and loan institutions. Sometimes used as a reference rate in swaps and bonds, particularly when short rates are expected to fall, because movements in COFI tend to lag short-term rates.

/floater: An FRN whose coupon is referenced to COFI.

/swap: A swap one of whose legs is referenced to COFI.

Collapsible swap: See callable swap.

Collar: A premium reducing options strategy in which the holder has bought a cap at one level and, to recoup some or all of its cost, has sold a floor at a much lower level. Collars are most commonly used to hedge interest rate risk but have also been used to protect equity portfolios, currency and commodity exposures.

For example a short US dollar cash position could be hedged with the purchase of a US$ call/DM put struck at 1.6000 and the sale of a US$ put/DM call at 1.5365. Assuming a forward rate of 1.5673 and volatility at 9.8% this three month collar would be zero premium. At expiry if the spot is above 1.6000 the underlying position is hedged by the purchased option. If spot is between the two strikes the underlying is exchanged at the prevailing spot rate. If it is below 1.5365 then the profits on the underlying are capped by the sold option. See cylinder, participating forward, range forward, risk reversal.

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Collared: Used of instruments to which a collar has been applied.

/**floating-rate note**: An FRN with a minimum and maximum coupon. Such **notes** contain two embedded options: the issuer (investor) is effectively long (short) a cap and short (long) a floor. Some collared FRNs incorporate caps and floors that step-up over the life of the note.

In a falling rate environment these notes outperform significantly since the cap is unlikely to be hit (so the investor stands to keep the premium) and the floor is gaining in value. Conversely, it underperforms significantly in a rising rate environment. In other words, the embedded options combine is a double-whammy of sensitivity to interest rate movements which gives collared FRNs surprisingly high duration compared with vanilla or floored FRNs.

/swap: An interest rate swap combined with an interest rate collar on the floating leg.

Collateralized swap: A swap agreement in which one or both counterparties puts up collateral to guarantee its ability to meet its obligations under the agreement.

Combination yield curve swap: A yield curve swap in which the returns from more than one market are swapped for the returns from one market. For example, a counterparty might pay the two-year CMS Deutschmark rate and receive 50% of the two-year CMS Deutschmark rate plus 50% of the two-year CMS yen rate

Commodity: A non-financial asset, such as oil, metal or sugar. Agricultural commodities are known as softs.

/derivative: A derivative contract on a commodity price or index. Exchange-traded futures and options are available on a wide range of oil, metal and soft products. The OTC markets also offer options and swaps on a variety of crude oils, on refined products not covered by the exchange-traded markets such as jet kerosene, non-ferrous metals, natural gas and electricity.

/interest (dividend)-indexed notes: A commodity linked note whose interest payments are tied to the price of a commodity or commodity price index.

/-linked interest rate swap: A swap in which an interest rate index such as Libor is exchanged for a commodity-price linked fixed rate. A user of aluminium might wish to link the price of his major cost, aluminium, to the price of his debt. He could elect to receive Libor and pay an aluminium-linked rate such that as the price of aluminium rises, the fixed rate he pays declines. It is also possible to swap a commodity price itself for Libor. See hybrid derivative.

/linked note: A bond or note with embedded long/short positions in commodity futures or options or commodity index options. These notes provide yield enhancement to either coupon or principal repayment if the investors views on commodity price movements are correct.

/option: An option on a commodity price. Commodity caps, floors, warrants and swaptions are available, as are options on the spreads between the prices of different commodities.

/swap: In its vanilla form an agreement identical to a fixed-for-floating interest rate swap except that the payment streams are based on the price of a commodity such as crude oil.

For example, an oil producer wishing to lock in the price of his production of 600,000 barrels a year can pay a floating rate equal to the pre-agreed price index times 50,000 barrels a month and receive a pre-agreed fixed amount per barrel on the same notional 50,000 barrels a month. The fixed price is set upfront by reference to the prevailing swap or forward market. An oil consumer would enter such a swap as a fixed payer. As in an interest rate swap, typically no physical oil changes hands. The producer continues to sell 50,000 barrels a month to the market and channels that floating payment stream into the swap in exchange for the fixed rate.

However, physical delivery can be accommodated.
A full range of commodity swap structures is available. Basis swaps of one floating index for another, particularly involving prices for commodities with different delivery locations, are common. Commodity yield curve swaps, known as backwardation and contango swaps, are also available.

Compound option: An option giving the holder the right but not the obligation to buy or sell another, pre-determined, option at a pre-agreed price. The commonest examples are options to buy caps or floors, known as captions and floortions. The classic application of a compound option is by companies tendering for contracts who will require currency or interest rate hedges if they win, but not if they lose. Compound options are cheaper than standard options but if both options are eventually exercised, the total premium for the compound options will be more expensive than the premium for a single normal option.

Concertina swap: An interest rate swap whose notional principal varies according to the present value of an existing fixed-rate paying swap and used to increase near-term protection from high floating rates. While the notional principal is normally adjusted within a concertina, rate and tenor can also adjusted. Also known as a net present value (NPV) swap.

Conditional forward purchase contract: A variation of the break forward, this is a forward agreement under which the party long the contract can cancel the forward purchase on payment of a fee. Instead of an upfront fee, the buyer of the contract can set a forward price below the market rate.

Condor: A complex spread trade executable in the futures or options market in which the holder is long and short two spread positions -- strangles -- on the same market. The position is limited on both the up- and downside and is directionally neutral.

Confidence interval: An estimate of the probability that an observation or a financial variable will fall inside or outside a designated range. Important in a range of financial modelling.

Constant maturity swap (CMS): For each maturity for which it is available the CMS rate is an index consisting of swap rates adjusted to that constant maturity. CMS rates are available in a number of major currencies and in Europe and Japan are used as a CMT equivalent because of the lack of regular government bond issuance across the curve. For investors in these countries the CMS index is a benchmark yield curve index.

/FRN: see constant maturity Treasury FRN.

Constant maturity treasury(CMT): CMT rates are indices consisting of the semi-annual yield of outstanding US Treasuries adjusted to a constant x year maturity. So the 10-year CMT would be adjusted to a constant 10-year maturity (hence they have no duration). CMT **rates** are calculated daily by the Federal Reserve and published weekly.

/FRN: A **floating-rate note** that resets on a quarterly or semi-annual basis but whose coupons are indexed off long maturity CMT indices. In a steep yield curve environment they can produce a significantly higher yield relative to comparable maturity vanilla FRNs as well as retaining upside in a bear market. The risk in the note is that, since the coupon is reset based on the long end of the yield curve, the note's yield advantage over a vanilla FRN will disappear quickly if the short rates rise faster than long rates (that is, the yield curve flattens) from initial levels. This effect is leveraged: on a five-year CMT FRN typically if the 0 to five year sector of the yield curve flattened versus the 5.25 to 10-year sector by one basis point, the note would lose 6. 1 bp of value. The equivalent investor position is long short maturity fixed rate paper, short longer maturity Treasuries.

/-Libor differential notes: A CMT-Libor differential note (a second generation structured asset because of the incorporation of multiple indices) pays the investor the difference between a CMT rate and a short-term Libor index. A typical note might have a three-year maturity and pay 5.00% for the first year and then the 10-year CMT **rate** less three-month Libor plus 1.60% reset quarterly with a minimum coupon of zero. This could give investors higher spot **floating-rate** yields than are possible with either the CMT FRN or vanilla FRNs. As with other CMT-linked **notes**, the main risk is that yield curve flattening will erode this advantage. The investor is effectively long a CMT FRN and long Eurodollar futures. This is one of the kinds of structured notes that Robert Citron, treasurer of Orange County, used to make the spread plays which were to prove so disastrous. He purchased one entire issue whose first coupon was 6% but whose reset a year later was 5.065% and six months later was close to 3.985%.

/options: Caps and floors on CMT rates.

/swaps: Swaps in which one leg is linked to CMT rates. Most commonly, both CMT and CMS rates are used in yield curve swaps where a counterparty pays the CMT or CMS rate at one part of the curve, say the two-year CMS or CMT rate, and receives it at a different part of the curve, say 10 years.

Contango: Originally a London Stock Exchange expression meaning to postpone payment and delivery of stock from one day to the next or the fee for this postponement. Nowadays almost always used of the commodity market to describe the situation in which the futures prices are above spot prices.

/swap: A commodity curve swap which enables the user to lock in a favourable contango, or positive spread, between forward and nearby prices. For example, an oil producer might pay the monthly average of the daily difference between the nearby and 12-month futures contract on a pre-agreed notional principal amount of oil and receive a fixed spread of 30 cents per barrel.

Another way of looking at the structure is that the producer pays a floating amount equal to the average of the 12-month futures contract and receives a floating payment equal to the average nearby contract plus the 30 cent spread. This enables the commodity producer to lock in the positive spread between forward and nearby prices and also to hedge against anticipated backwardation.

Contingent: In derivative products this term usually means 'dependent on'. Thus:

/option: An option whose existence is dependent on another index level being triggered. Once that trigger is hit, then another option with another (or the same) strike comes into being.

/premium option: A path-dependent option for which no upfront premium is payable. The premium is paid at expiration and only if the option expires in the money. Even if the option is in the money, but not deeply enough to recoup the premium, the option still has to be exercised and the premium paid. If the option expires at the money or out of the money, no premium is paid. For the option holder to benefit, the option either has to expire at or out of the money or it has to expire sufficiently deep in the money to recoup the contingent premium. The premium is more expensive than a conventional option premium because it is paid only if the option expires in the money, and this is not guaranteed. The premium can be approximated by dividing a conventional premium by the probability of the option expiring in the money, that is its delta, adjusted for the time value of money.

Contingent premium options are constructed from the purchase of the conventional option and the simultaneous sale of a digital option struck at the same level with a payout equal to the premium the provider of the contingent premium option calculates as sufficient compensation. If the option moves into the money, so does the digital creating the premium payment. If the option remains out of the money, so does the digital -- so no premium is payable. Contingency has been applied to caps, floors, swaps, swaptions and other options. It is most commonly applied to caps, where the structure is often modified slightly: the cap buyer pays a small upfront premium and then has to pay a further premium installment if the selected index (usually of interest rates) fixes above the pre-set contingency level. If the contingency level is never reached, then the premium is lower than for a conventional cap. If the contingency level is breached then the total premium payable is higher. See deferred premium option, installment option, mini premium option, part contingent option, pay-as-you-go option.

/swap: A swap activated by a specified event and usually paid for with a premium. Swaptions can be viewed as contingent swaps.

Continuous swap: The combination of a vanilla swap and a long-dated forward so that the swap maturity is  maintained at a constant tenor.

Conversion: An arbitrage trade so called because it can be used by the holder of a put to alter his position to a call or vice versa.

Converting a put to a call involves the purchase of the put, purchase of the underlying or future and sale of a call. The options have the same exercise prices and expiration date. This position is itself called a conversion or long option box.

A call is converted to a put by buying the call, selling the underlying or future and selling a put. This position is called a reversal or short option box. See reversal.

Convexity: Convexity is the second derivative of price with respect to yield. It is a time-squared weighted average maturity measure and describes how duration changes with yield -- that is it describes the rate of change in the price of an interest rate product for a given movement in interest rates -- and is a corrective to the limitations of duration as a measure of sensitivity.

This price/yield relationship is convex in shape if plotted (hence the name): the smaller the radius, the higher the convexity. So the rate of change in the price of an instrument with zero convexity is linear: it changes price in a constant ratio whether rates go up or down. An instrument with positive convexity will appreciate more in price for a decline in rates than it will depreciate for the same back-up (rise) in yields. An instrument with negative convexity falls faster in price for a given rise in rates than it rises for the same fall.

Fixed-rate bonds and swaps (receiving fixed) have positive convexity. Mortgage bonds, index amortizing swaps and other bonds or swaps containing embedded options have negative convexity.

When used of an option, convexity indicates a difference between the rate of change of the option premium and the underlying for a given movement in the underlying; it is measured by gamma. An option with positive (negative) convexity performs better (worse) than delta predicts for large changes in the underlying.

Correlation: A measure of the degree to which changes in two variables are related. Correlations between markets or products are important in hedging all types of portfolio, in arbitrage and in index replication.

/dependent options: options whose payoff depends on the correlation between two or more currencies or asset classes. See basket options.

/risk: Generally, the risk that two variables or instruments are correlated in a way that is unfavourable. Identifying and quantifying correlation risk has become a key element in pricing and hedging certain products.

In yield curve options, spread options and cross-currency caps, the correlation between the underlying assets is called a first-order effect as it directly affects the option price.

In quanto products, like differential swaps, there is a second order or indirect effect, in that case between interest rates and exchange rates.

/coefficient: a number between minus one and plus one that indicates the strength and direction of a linear relationship between two variables. A correlation coefficient of minus one indicates that they are perfectly negatively correlated, zero that they are not correlated at all and one that they are perfectly correlated. The correlation co-efficient is a normalized measure of covariance used because it is a unit-free measure (its value is not influenced by the size of the values of the observation).

Corridor: A premium-reducing options strategy in which the holder is long a cap at one level and short another at a higher level. The holder of the corridor is protected against rate rises between the strikes of the two calls. Unlike the holder of a collar though, the holder benefits fully from any downward movement in rates. Also sometimes applied to a collar on a swap created by using two swaptions.

/option: An option (most often used in the FX markets) that profits to the extent that the underlying trades within a pre-set range. The buyer specifies the range and pays a premium upfront. The option's maximum payout is specified in advance as a multiple of the premium. Then, for every day (week, month) in which the underlying trades within the range, a portion of that maximum payout is locked in. No daily payment is made if the underlying trades outside the range. The final payout is calculated on a pro rata basis. The corridor option is often embedded in notes to create accrual or range FRNs. It differs from the similar range binary option (which is used to create binary accrual or range FRNs) in that a breach of

the range boundaries does not lead to the termination of the entire structure as it does with the range binary product. See boundary binary option, digital option, limit binary option, range binary option, range floater.

Coupon swap: See interest rate swap.

Coupon accrual swap: See accrual swap.

Covariance: A measure of how two random variables behave in relation to each other. Matrices of covariances are used in several different financial models, the most famous of which is Sharpe's capital asset pricing model. See Arch.

Covered: Cover is a long position in on instrument that offsets partially or wholly a short position in another. Hence:

/call: The sale of call options while long the underlying instrument. Also known as a buy-write. The covered call writer gives up any upside potential beyond the strike of the calls in exchange for the premium income. If he believes that the price of the underlying will exceed the strike, then this is a form of forward sale.

/put: The sale of put options while long the underlying. Also known as targeted put selling because the writer is effectively targeting a price of which he will buy the underlying while increasing its yield by taking in option premium.

/warrant: A warrant covered either by other warrants or by holdings of the underlying which entitles the holder to buy existing securities in a company at a pre-set price for a given period. Originally a feature of the Japanese cum-warrant bond market where warrants were stripped from bonds and then repackaged, covered warrants have become popular in Germany and Switzerland (where they are known as stillhalter warrants.)
Cox-Ingersoll-Ross: A generalization of the Black-Scholes option pricing model incorporating the work of John Cox, Stephen Ross and Jonathan Ingersoll. The model represents one of the two approaches followed by term structure option pricing models. It models the expected returns from movements in the term structure in order to price them. The second approach, followed by Ho-Lee, Heath-Jarrow-Morton, Black-Derman-Toy, and Hull-White utilizes the volatilities of the various sectors of the term structure to derive a probability distribution for an arbitrage-free binomial, trinomial or multinomial lattice of the term structure. These models all have one thing in common: they allow for the whole-term structure to be stochastic instead of the price of a single underlying instrument or a single interest rate. The whole-term structure is represented at each node of the lattice. This methodology allows both long-term and short-term interest rate instruments to be priced with an internal consistency not possible if different models are used to price different instruments.

Crack spread: The spread between the price of crude oil and the refined ('cracked') distillates such as gasoil and naphtha. Also known as the refiners' margin.

/option: An option on the crack spread -- a type of rainbow option.

/swap: A commodity swap that enables refiners to lock in a margin by paying the floating price of the refined product or products, calculated as an average over a pre-set period, and receiving the floating price of its chosen crude oil feedstock plus a fixed margin -- the crack spread. By locking in this margin, refiners can hedge against a narrowing in the

differential between crude oil prices and the prices of the refined products it produces. However, in so doing they give up the right to profit from any widening of the spread.

Credit derivative: Derivatives which enable holders to hedge or take views on credit risk in isolation. Examples are: a junk bond swap under which the investor pays Libor plus 100 bp and receives the total rate of return of a basket of junk bonds marked-to-market of each reset. The counterparty would be a bank who wishes to reduce exposure to the high-yield market while the investor gets off balance sheet exposure to high-yield securities, perhaps that he is not permitted to buy directly; a bank-loan swap in which the investor pays the interest rates due on a basket of loans and receives a Libor-based rate above that of each loan; or simply a call option on the spread between Mexican and US Treasuries.

Credit spread: The difference in yields between fixed-income instruments of different credit qualities. Also the term used to describe the options position created by the combination of a call bear spread and put bull spread. See debit spread.
/option: A form of credit derivative, this is an option on the spread between two fixed-income indices with different credit bases, for example the spread between yields on a double-A corporate bond index and that on comparable US-Treasuries. They are used by regional banks, insurance companies and fund managers either to hedge the credit risk of their portfolio or as a tool for picking up yield.

/swap: See bond index swap.

Cross-category structured assets: Bonds or notes whose performance is linked not to fixed-income indices or spread differentials but to the performance of other asset classes. See currency indexed note, commodity linked **note**, equity linked **note**, bond index **note**.

Cross-currency: Used of any instrument that involves the explicit or implicit exchange of cashflows denominated in more than one currency. So:

/basis swap: A **floating-floating** interest **rate** swap with payments denominated in different currencies.

/option: One option or a series of options whose payout is based upon a reference (foreign) Libor exceeding (cap) or falling below (floor) an absolute strike rate with respect to the base (domestic) Libor. The payout is denominated in the base (domestic) currency.

So, under a spread rate or cross-currency cap, the buyer receives the spread between two interest rates in different currencies minus a strike spread.

The cap version is commonly used to cap the foreign Libor payment stream in a differential swap. It can be viewed as a strip of options on forward spread agreements. The floor version is used to ensure that coupons in leveraged currency protected **notes** do not become negative. Also known as a (spread) **rate** differential option.

/swap: A fixed-for-**floating** currency swap. Also known as a currency coupon swap. See currency swap.

/swaption: A swaption in which one counterparty sells/buys the right to enter into a currency swap with another counterparty on a pre-determined date under which the first counterparty pays a pre-set fixed or floating rate in one currency in exchange for a pre-set fixed or floating rate in

another currency. The principal amount for final exchange is set for both currencies. Initial exchange of principal amounts is not necessary. A borrower who wished to reduce his funding costs by issuing a note denominated in one currency but convertible into one denominated in another could use this instrument to hedge against investor exercise.
Cumulative option: A path-dependent option whose payout is based upon the cumulative price performance of an asset over pre-set intervals. One of the commonest applications is the Q-cap (for Cu-). A cumulative cap caps annual interest expense at a pre-set level. For example, a borrower with a two-year $10 million floating-rate loan might have budgeted $600,000 in interest costs for the year. They can purchase a cumulative cap at $600,000 which fixes their maximum interest cost at $ 600,000. See Q-cap.

Currency basket option: An option on a customized portfolio of currencies. The option uses a pricing model that creates an index that represents the base currency value of a predetermined portfolio of foreign exchange positions corresponding to the exposures of the option buyer. The strike price of the option is set relative to the index allowing the option buyer to hedge against the base currency value of the portfolio falling below a certain point while retaining the potential to gain if the portfolio rises in value. The premium of the option will reflect the correlations of the basket components: if they are negatively correlated, then moves in the value of one component will be neutralized by opposite movements of another. Unless all the components are highly correlated, the option will be cheaper than a series of individual currency options. The same principles apply to interest rate basket options.

Currency indexed note: A bond or note whose performance is linked to a predetermined cross rate. There are two types: the coupon currency indexed note and the principal currency indexed note (also known as a principal exchange rate linked note -- PERL). The former pay any yield enhancement via a higher currency linked coupon, the latter through capital gains. A typical note might pay no coupon but have redemption formula of 100% x [1 + 1.5 x (FXmat -- 1.6925)/FXmat] where FXmat is the DM/US$ cross-rate at maturity. Some notes had a further barrier-like condition that would trigger a predetermined redemption level (say 110%) if a particular rate were breached at any time by the underlying. The note's value is dependent upon the spot rate, US interest rates and German interest rates. Marking these notes to market (as opposed to buy and hold strategies) is very complex.

Currency option: The right but not the obligation to buy one currency against another. Since the right to buy one currency for another is the same as the right to sell that currency for the other they are typically described thus: Deutschmark call/dollar put.

Currency protected: Used of instruments which give the buyer exposure to a foreign index or asset without the exposure to the foreign currency that would normally follow. See quanto, quantize.

/note: A bond whose coupon is linked to interest rates in one (usually foreign) currency, but which is denominated in another (usually domestic) currency.
One example might be a US dollar FRN paying a US investor Deutschmark Libor in dollars. Versions, in which investors receive three-month Libor in one currency less three-month Libor in another less a fixed spread have also been popular as have versions of this structure leveraged up to ten times. Other versions are simply quantized versions of common structures. For example, the commonest initial structures were quantized inverse **floaters**. For example, a **note** paying 9.11% minus six-month sterling Libor paid in US dollars would provide a currency risk averse US investor with a bullish interest **rate** play on

sterling.

Initial bullish quanto notes were based on Libor when high short-rates and flat/inverted yield curves in Europe gave investors high upfront coupons. When yield curves become positive with an inversion between short-term Libor rates and two- and three-year rates after the ERM crisis, these short-term lined notes produced smaller initial coupons and so interest switched to CMS-linked notes.

/option: An option denominated in one currency on an asset denominated in another. An option on the Nikkei index denominated in dollars is one example. (In fact, such Nikkei-linked options were the first quanto products to take off.) These options give holders exposure to their desired underlying foreign asset without the worry of currency exposure. As with the differential swap, the difference in cost between quanto options and standard options is a function of the correlation between movements in the underlying asset and its currency. If they are positively correlated, a call will be cheaper and a put more expensive. Also known as a guaranteed exchange rate option.

/swap (CUPS): An interest rate basis swap in which the buyer pays an interest rate in one currency, usually his domestic Libor, and receives a second currency's Libor plus or minus a spread with all payment streams denominated in the same -- again, usually the buyer's domestic-currency.

It was the boom in this product that spurred the search for correlation risk because of its importance in pricing these swaps. A swap writer paying Deutschmark Libor in dollars and receiving dollar Libor in dollars funds the Deutschmark Libor payout through the swap market. He is therefore hedging US$ denominated DM interest rate risk using DM denominated instruments. So, even if interest rates remain the same, he is exposed to the risk that the dollar will strengthen, leaving him too few Deutschmarks to pay his dollar liability. Although the prevailing exchange rate will determine the initial size ('quantum') of the hedge, ongoing changes in exchange rates will vary the size of the hedge required.

Hedging this risk means taking a view on the correlation covariance between interest rates (DM Libor) and DM/US$ exchange rates. That is, to what extent will arise in Deutschmark interest rates, and so the amount of money the swap writer must pay out to the buyer, be offset by a strengthening of the Deutschmark against the dollar? Known by a large number of other names including cross-indexed basis (CRIB) swap, cross-rate swap, diff, differential swap, interest rate index swap, Libor or rate differential swap.

Currency swap: The spot sale/purchase of one currency for another combined with a simultaneous forward agreement to repurchase the agreed currency amounts at a pre-set date and an agreement by the counterparties to exchange the interest payments on their swapped currencies. Also known as a cross currency swap, cross-currency rate swap.

Curve lock: Any instrument which locks in the spread between two different points on a yield  curve.

/swap: The combination of a yield curve swap with an obligation to enter into a swap at a future date. They are common in both financial and commodity markets where they are used either as outright speculation on future curve movements or to benefit from a favourable curve shape when the absolute level of the underlying market makes entering into a swap outright unappealing.

For example, instead of simply entering into a contango swap, an oil

producer unwilling to fix the price of his production at current low swap rates can enter a curve lock swap. Under this he agrees to enter a swap whose rate is set at a differential to a nearby futures contract before the expiry of that futures contract. If his belief that the contango will diminish proves correct and spot prices rise, the futures price will rise and he will be able to trigger the swap at a significantly higher level than was available in the swap market originally. The differential provides a cushion if spot prices fall.

Curve swap: See yield curve swap, contango swap, backwardation swap.

Cylinder: A position long a put option and short a call option with a different strike price, or long the put and short the call again with a different strike. The position provides a tailorable level of downside protection with the premium reduced by the amount of premium income received at the expense of forgoing upside participation. A bull cylinder is long a put, short a call and the underlying asset. A bear cylinder is short a put, long a call and long the underlying. Both these positions are also known as fences. See collar, range forward, risk reversal.

D

Debit spread: The option position created by the combination of a call bull spread and a put bear spread.
Debt warrant: A warrant giving the holder the right but not the obligation to buy a specific bond. Warrants are available on a variety of government debt instruments and debt warrants are also occasionally attached to public bond issues by corporations and financial institutions.

Deferred: Many derivative instruments can be postponed or have parts of their mechanisms postponed. Thus:

/payment option: An American-style option which allows the holder to freeze the underlying price at which it will be exercised. The intrinsic value of the option is paid on maturity. Also known as a deferred payout option.

/premium option: An option on which the premium, instead of being paid upfront, is payable when the option is exercised or expires. At this point the premium is netted against any payout and the remainder is paid by the option holder to the option writer. See contingent premium option.

/start option: Options which exist and can be traded before they are activated, such as barrier options.

/strike price option: An option that allows the holder to rate for a predetermined period after its trade date. These options allow the holder to lock in current low levels of volatility in the expectation that volatilities will rise.
/swap: A swap in which some or all of the payments are deferred for a pre-set period after they have been calculated and come due. These are tax or accounting driven and payments tend to be deferred across fiscal year ends and other key balance sheet dates.

Delayed Libor reset swap: See Libor-(set)-in-arrears swap.

Deleveraged: Used of derivatives or notes with embedded derivatives whose payoff is linked to a fraction of some index or variable, just as leveraged is used of instruments whose payoff is linked to a multiple of an index, spread or variable.

/Prime FRN: A **floating-rate note** that pays
a coupon of the type 0.5 x (Prime) + 0.80%. The term deleveraged refers to

the fact that the coupon index is a fraction of Prime. By deleveraging, the investor obtains a higher upfront floating rate coupon than is achievable with a Prime FRN at the time of purchase. He receives this higher coupon in exchange for assuming the risk that if Prime rises significantly, he will only participate in half the rise.

/CMT FRN: See step-up recovery floater (SURF).

Delta (character omitted): Mathematically the first partial derivative of the option price with respect to the underlying price, delta is the rate of change of the value of an option for a given change in the value of the underlying asset. It is an absolute change measured in currency units. An option with a delta of 0.5 is expected to change in value 50 cents for every $1 move in the underlying.

Delta is also the neutral hedge ratio derived from the Black-Scholes model. So the delta of a stock option indicates the number of shares needed to hedge a position in an option on that stock -- for example a portfolio long 100 stock call options with delta of 0.3 is hedged by a short position of 30 shares -- and the delta of an interest rate option indicates the notional amount of interest rate swap required to hedge it against small movements in interest rates. (In fact there are many different ways in which delta can be defined for interest rate options: delta can be calculated with respect to the underlying bond price, with respect to each underlying forward interest rate (as sometimes with cap deltas), or with respect to a small parallel shift in the zero coupon yield curve so that delta is the change in the option price for a small change in all zero-coupon rates.)

Delta can also be interpreted as the probability of a call option expiring in the money: an at-the-money-forward option has a delta of 0.5, since with an equal probability that the underlying will next move up or down, the option has a 50% chance of expiring in-the-money and a 50% chance of expiring out-of-the-money.
Delta increases in a non-linear fashion from zero to one as an option moves from far out-of-the-money to deep in-the-money. This is because a deeply in-the-money option has a high probability of expiring that way and so will act as a proxy for the underlying, rising and falling in a 1:1 ratio with it. A deeply out-of-the-money option will have little probability of being exercised, so a small change in the price of the underlying will do little to close the gap between asset and strike price. In addition, the closer an option is to the money, the faster delta changes. Delta also increases with time to expiration and with volatility for out-of-the-money options and decreases with time to expiration and with volatility for in-the-money options; it is also pushed up by rises in interest rates.

/hedging: As derived from Black-Scholes, delta is the ratio of underlying asset to options necessary to create the risk-free portfolio that is at the heart of the formula. Delta hedging is the application of this concept to the hedging of options portfolios. A true delta hedge is the combination of underlying asset and money market instrument that creates the riskless hedge Black-Scholes says will exactly replicate the pay-off of the option to be hedged. Less specifically an option is said to be delta-hedged if an offsetting position has been taken in the underlying asset in proportion to the option's delta.

/neutral: An option portfolio delta-hedged such that it has no exposure to small moves in the price of the underlying. In practice, since delta is altered by all but the very smallest changes in the price of the underlying, by the volatility of that price, by the maturity of the option, by how close-to-the-money the option is and by interest rates, the ratio of

options to underlying must be constantly rebalanced to maintain delta neutrality.

/positive: Call options are said to be delta positive because their value increases by the value of delta for a one unit rise in the price of the underlying. Put options are said to be delta negative because their value decreases in value by Delta for every one unit rise in the price of the underlying. That is, the delta of a call is a positive function of the level of the price of the underlying and that of a put a negative function.

This relationship is upset in barrier options. A knock-out call/put will behave normally until, at a point near to the knock-out, any further increase/decrease in price will cause the value of the call/put to drop because the probability of its being knocked-out is more significant than the fact that it is moving further into the money. At this point puts become delta positive and calls delta negative.

Derivative instrument: A security or contract whose value is dependent on or derived from the value of some underlying asset. The main classes of derivative instruments are: forwards, futures, options (and their securitized equivalents, warrants) and swaps. There are derivative contracts on currencies, commodities, equities, equity indices, interest rates and combinations of these. Derivatives can be exchange-traded or over-the-counter The latter are contracts between counterparties and are telephone and screen traded by banks outside the regulated exchanges.

Diagonal spread: So-called because it is a cross between a horizontal and vertical spread, this is an option spread trade in which the holder is short options of one maturity and strike price and long options of a different maturity and different strike price. A diagonal bull spread is the sale of a shorter maturity option and purchase of a longer maturity, lower strike price option. A diagonal bear spread is the purchase of a longer maturity option and sale of a shorter maturity, lower strike price option.

DIFF: Shorthand for the forward interest rate differential between comparable fixed-income instruments denominated in different currencies. As a verb 'to diff' is used to mean quantize.

/swap: Short for differential swap.

Difference option: The general class of options of which spread options, rain bow options and cross-currency caps are examples. Difference options pay the holder the price difference between two underlying assets if that difference is greater than that specified by the initial strike price.

Differential swap: See currency protected swap.

Diffusion process: A continuous-time model of the behaviour of a random variable that uses geometric Brownian motion as its basic assumption. In the Black-Scholes model, the price of the underlying follows a pure diffusion process -- that is, it is assumed to move continuously from one point to another. The consequence of the is assumption is that the terminal distribution of share prices is lognormal. Other models, particularly discrete-time models, use modifications of the process.

Digital option: An option whose payout is discontinuous. If the strike price is reached, the payout is a fixed, pre-determined amount no matter by how much the option is in the money. This amount is usually expressed as a multiple of the premium: a payout of 1:2.5 would mean that the option would pay 2.5 times the premium invested.

The simplest digital options are at-maturity or European digitals. These are path-independent cash-or-nothing/all-or-nothing options: a call (put) pays nothing if the underlying asset price finishes below (above) the strike price or pays a predetermined constant amount if the underlying asset price finishes above (below) the strike price. Versions of these are available, called asset-or-nothing digitals, payout the value of the underlying at maturity of the spot trades above (call) or below (put) the strike levels. And digital gap options, pay out a sum defined by the underlying asset price minus a constant.

Path-dependent varieties are also available in the form of digital barrier options. The 'in' versions are digital options whose payouts are automatically triggered either as soon as the underlying asset price hits the barrier or at expiration as long as the barrier has been hit at some point during the option's life. These are essentially American-style digitals and are sometimes called touch or one-touch options and some varieties require that the barrier has been hit more than once. The 'out' versions are digital options which payout as long the barrier is not hit.

The conditions that determine a digital option's payout are many: for example, a spot rate trading or not trading at a certain level, a range maintained or broken and a level trading only after another level trades.

More complex versions are also available which pay out (or do not) only when the barrier has (has not) been hit and the asset price reaches (does not reach) a predetermined point.

Like barrier options, digital options are difficult to hedge because, around the barrier, small moves in the underlying can have very large effects on the value of the option. In this respect the pricing characteristics are similar to swaptions. Digital options are cheaper than conventional options and should be preferred to them when the purchaser expects the option to move only marginally into the money since the payout is large compared to a small movement in the underlying but would represent a limitation on profit potential if the underlying were expected to move substantially. Digital caps and floors are the commonest naked digital products with the digital cap being useful where rates are expected to move far enough to trigger the option but where a conventional option would represent the purchase of unwanted protection. A number of exotic swaps and options contain embedded digital options. See accrual swap, range-FRN, contingent premium option. Also a number of products known as binary options are in fact combinations of simpler digitals: see boundary binary option, corridor option, limit binary option, range binary option.

Difftions: Option on a diff(erential) or currency protected swap.

DIRF: Acronym for differential interest rate fix -- a contract that allows the holder to lock in the spread between different parts of the same yield curve. It is customized in terms of settlement dates, value per basis point and predetermines two points on the yield curve. For example, an investor might believe that the UK swap curve will flatten over the next year more than is currently implied by the market. He could sell a two years versus seven years DIRF for settlement in one year. He would select an amount per basis point, say L1 million, and would receive the DIRF price. He is selling the spread or difference between the implied forward rates for the two yield curve points chosen, in this case the one year forward two year rate and the one year forward seven year rate. If the curve flattens more than the implied forward rates suggest, then this investor will be able to close his position profitable. An investor who believed that the curve would steepen, that is that the spread would widen, would buy the DIRF. The trade can be reversed at any time to take profits or limit losses and the DIRF has no exposure to parallel movements in the yield curve. However,

investors must note that expected moves are already priced in as the trade is priced off the implied forward curve. See forward spread agreement, yield curve swap, curve lock.

Discount swap: A swap in which the fixed-rate payments are below the market rate. At maturity the discount is repaid with one payment. The structure is useful in financing projects which will not generate income to pay under the swap until they are completed.

Distribution: The patterns of values of a variable associated with particular statistical models. Assumptions about the distribution of the probabilities associated with prices of the assets that underlie option contracts occurring in the future are used to determine the probability that an option will be exercised. The value of the option is then derived from this probability.
All things being equal, the larger a distribution of expected values of the underlying asset of an option, the higher the option premium. This is because a large distribution will encompass a large number of extremely in-the-money outcomes which are not offset by equally large negative returns (since an option cannot be worth less than zero). A small distribution will generate a low option value since only modest positive returns fall within the realms of probability. In the case of the assets that generally underlie options contracts, the size of the distribution depends on time and volatility. The more time there is for the asset price to move, the more potential values it can have and so the larger the probability distribution. Since this also means the more likelihood of the option being exercisable in-the-money, it means the greater the value of the option. Likewise, the greater the volatility of the underlying, the larger the distribution, and the higher the value of the option. This means that the distribution curve applicable to a given option is constantly changing. An option premium is also affected by the location of the distribution curve relative to the strike price. For an option where the forward outright is equal to the strike, half of the possible outcomes will be positive and half zero (as a result of the random walk assumption). If the market moves so that the option moves into the money, so a larger number of possible outcomes will be positive, and some highly positive outcomes become possible which were not before, and so the value of the option rises. Conversely, if the option moves out-of-the-money, relatively few of the possible outcomes will be positive, and more will be zero. This will cause the value of the option to fall. The commonest distributions assumed by option pricing models are normal distributions, lognormal distributions and binomial distributions.

Double barrier option: A barrier option in which there are not one but two instrikes or outstrikes or combinations of the two.

Double-up swap: A fixed-for-floating (usually commodity) swap in which the fixed-rate payments are set lower than the market rate. In exchange, the fixed-rate payer grants the floating-rate payer a put option to double the notional amount of the swap if the spot price of the underlying falls below a pre-set strike price, usually the same as the discounted swap rate. The difference between the off-market and market rates represents the premium for this embedded option. If the strike is hit, then not only is the fixed-rate payer paying a higher price for the underlying than the current spot rate, he is paying it on twice as much as the original notional principal of the swap. If a commodity user/producer uses double-up swaps to hedge more than half their real requirements/production and the option is exercised, he ends up overhedged. That is effectively speculating, since he has fixed prices on more of the commodity than he has a true underlying exposure to.

Double option: See chooser option.

Down-and-in-option: A barrier option activated when the price of the underlying moves down through a pre-set strike price or barrier level known as the instrike. See down-and-out option.

Down-and-out: A barrier option that is deactivated when the underlying trades through a pre-set barrier level.

/floored swap: The combination of receiving floating under an interest rate swap and the sale of a down-and-in floor with the instrike set well below the fixed rate on the swap and with a strike at the swap rate. For example, a down-and-out floored swap might fix a floating-rate borrower's cost of funds at 5.90% if rates rise above 5.90% while allowing him to benefit from rate falls down to 4%. If rates do hit 4% though, the down-and-in floor is exercised against him at 5.90%. So if Libor is above 5.90% or below 4% the borrower is fixed at 5.90%.

/option: A barrier option deactivated when the price of the underlying moves down through a pre-set strike price or barrier level known as the outstrike. For example, a European-style down-and-out floor would knock-out if rates fell below a certain level. They can be structured with progressive knock-out levels -- in this case, levels that move down with every reset.

Drawdown swap: See accreting principal swap.
Drop-lock swap: A deferred-start interest rate swap in which the fixed-rate payment is reset to a lower/higher pre-agreed level if, between the time of the agreement and the commencement of the swap, the floating reference rate drops below/rises above a predetermined level. The amount of time for which it remains below/above this level is also a variable in some drop-lock structures.

Dual: Used of any structure involving two key variables.

/coupon swap: A fixed-for-floating interest rate swap in which one counterparty has the right to alter the currency in which payments are made contingent upon a predetermined move in exchange rates -- usually if rates move against the swap's base currency.

/currency bond: The combination of a fixed-rate bullet-repayment bond and a long-dated forward contract to create bonds whose principal is denominated in one currency but whose **interest** payments are in another. See currency indexed no, reverse principal exchange rate linked **security**.

/currency option: An option settled in either of two currencies at the choice of the option holder.

/currency swap: A currency swap used to hedge issuers of dual currency bonds against the foreign exchange risk embedded in them. Dual currency bonds have coupons denominated in one currency and principal in another. A dual currency swap contains the series of embedded options and swaps necessary to hedge the coupon payments into the issuer's required currency.

/index **floating-rate note**: Any **floating rate note** whose payoff is determined by the relationship between two underlying indices. An example is the CMT Libor differential **note** -- these pay a coupon of the type (10-year CMT minus six-month Libor) + 3.1%. A variant, the stepped dual index **floater**, pays a fixed first coupon before reverting to the dual index formula.

/index inverse **floating-rate note**: An FRN

whose coupon or principal redemption rises as the spread between (of the average of) two **rates** falls. For example, an investor might believe that lira and peseta short-rates are unsustainably high. If so, they could purchase a note that redeemed at par + 10 x (8.70% -- average Lit/Pta 3-year swap rate). This version is leveraged 10 times: every 1 bp change in the average results in a 10 bp change in redemption value.

/option: A name sometimes given either to chooser options or to two-colour rainbow options.
/strike option: See contingent option.

Duration (Macaulay duration): The present value weighted average term to maturity of a fixed- income instrument expressed in years. It is calculated as the average life of the present values of all future cashflows -- both coupon and principal payments -- of an instrument, with the time delay until receipt of each cash flow weighted by the contribution of that cashflow to the total present value of the instrument. Duration is therefore shorter than maturity for most bonds. The higher a bond's duration, the more sensitive its price to small changes in yield. Excepting perpetuals and very long maturity bonds, the longer the maturity of a bond, the higher its duration and, for a given maturity, the higher the coupon, the shorter the duration. The maturity of zero-coupon bonds is equal to their duration.

/(modified): A related measure, modified duration = duration/1 + (yield/(coupon frequency x 100)). That is, it is the percentage change in price of an instrument per basis- point change in yield. For a 1% change in yield, an instrument with a modified duration of 1.5 will change 1.5% in price in the opposite direction. Modified duration is sometimes known as volatility.

/-enhanced note: Short-dated fixed-income securities which pay an enhanced coupon and incorporate a leveraged redemption formula indexed to shorter-term swap rates. Despite maturities of only two or three years, the sensitivity of these instruments to movements in short-term interest rates matches that of much higher duration bonds. The higher the degree of leverage, the higher the synthetic duration. The majority are launched from medium-term note programmes.

/matched hedge: A risk offsetting position constructed from a long position in one instrument, such as a government bond, and a short position in another instrument, such as an interest rate swap, which may have a different maturity, coupon, yield to maturity and equivalent life to the first but which has an identical duration.

Dynamic hedging: Replication of the payoff of a portfolio long the underlying and long a put by continuous delta hedging. It started as a risk management theory of Hayne Leland and Mark Rubenstein on the back of the insights of the Black-Scholes model. It was used to provide put protection for equity portfolios at a time when portfolio puts were not available.

The theory assumed that an option position could be replicated by continuously adjusting the fraction of funds invested in the underlying equities with the remainder invested in a risk-free asset. An initial hedge of treasury bills was created, its size depending on the level of protection required. If the portfolio value fell, stocks had to be sold and the hedge position increased; the opposite had to be done if its value rose. The theory worked as long as volatility was predictable and low and while markets did not gap dramatically. Since it relied on a large amount of trading in the underlying, it also required liquid markets and low bid/offer spreads. The price discontinuity experienced in the 1987 crash caused such strategies to lose money and credibility. Also known as

portfolio insurance.

See replication.

E

Elasticity: Properly a measure of the percentage change in the option premium for a 1% change in the asset price. Sometimes loosely used as a synonym for delta (delta strictly measures the absolute change in the option premium for a one unit change in the underlying). Because elasticity is usually significantly positive(a 1% change in the asset price generally gives rise to more than a 1% change in the option price) it is also sometimes used as a synonym for gearing. This is most common in the warrant market, where it is calculated as delta times the price of the underlying divided by the option price. See leverage.

Embedded option: An option implicit in another instrument. The commonest are: call options embedded in bonds, which allow the issuer to redeem the bond early; the options implicit in bonds with sinking funds; the embedded put provisions in some bonds, that allow investors to put the bond back to the issuer at a predetermined price; the caps in capped FRNs; the equity call options in convertibles and exchangeables; the mortgagee's prepayment options in mortgage-backed bonds; the options represented by attached debt or equity warrants; the currency options in dual-currency bonds and the debt or interest rate options in pay-in-kind bonds. Embedded currency, commodity, equity and interest rate options have become commonplace in both the private and public debt markets.

Embeddo: A bond containing an embedded option or, sometimes, the option itself.

Equity index:

/-linked note (EIL, ELN): A fixed-income security whose principal repayment (less commonly coupon payments) are linked to the performance of a single stock, an equity basket or, most commonly, an equity index. The formula for principal repayment can reflect a long, short or more complex option-related position in the index. Most equity-linked notes are capital-guaranteed and each bank has a name for its own offerings: protected equity-linked notes (PENs), index growth-linked units (IGLUs), protected equity participations (PEPs), protected index participations (PIPs), equity participation notes (EPNs) and guaranteed return index participations (GRIPs).
/swap: A swap in which the (usually total) returns on an equity index, sub-index or customizable basket of equities, plus or minus a fixed spread, are exchanged for a stream of payments based on short-term interest rates, usually Libor. Typically both the index-return payments and the floating-rate payments occur monthly or quarterly. As with an interest rate swap, the payments are calculated on a notional principal amount that is not exchanged. The payment streams can be denominated in the same or different currencies. Quantized equity swaps have been popular with investors venturing into foreign markets for the first time and who do not want currency exposure. They also allow rapid asset reallocation with minimal transaction costs.

An equity swap is essentially a long-term equity future and so the cost of carry is crucial in pricing. The payer of the index return is short the index. To hedge this position he borrows floating rate, using the Libor payment stream he receives from the swap counterparty to service the loan, and buys the index. To fulfil his obligation to pay the total returns from the index, he pays out the dividends and capital appreciation he receives from his position in the index.

Equity option: The right but not the obligation to buy (call) or sell (put) an underlying equity instrument. Equity options are available on individual stocks, baskets of stocks (often related in geography or sector), and equity indices and sub-indices. Securitized versions in the form of listed and OTC warrants are also widely available.

Equity yield enhancement security (EYES): A security whose return is linked to a single stock but whose maximum return is capped. In exchange for the implied sale of a cap the investor receives a return that exceeds the stock's dividend.

Escalating (principal) swap: See accreting swap.

Escalating rate swap: An interest rate swap whose fixed-rate payments rise over time. Also known as a step-up coupon swap.

European-style option: An option which can only be exercised on expiration. See American-style, Bermudan-style.

Epsilon (E): See vega.

Exercise: Of an option, to put into effect the right to buy or sell.

Exchange option: An option giving the holder the right to exchange one asset for another. Used where there is no cross-market option, exchange options have largely been replaced or renamed: for example, the option a exchange one yield curve for another is a spread option.
Exchange rate agreement (ERA): A type of synthetic agreement for forward exchange (SAFE) that is settled on the spread between two forward foreign exchange rates instead of with reference to the spot rate.

Exchange-traded contract: A futures or option contract traded on an organized exchange by exchange members. Exchange-traded contract tend to be short-term, standardized and limited in complexity though innovation is changing this. See over-the-counter, futures contract, Flex option.

Exotic option: Any option whose strike price calculations, determinations, payoff mechanisms or activation/expiration conditions produce a payoff more complicated than that of a vanilla put or call. Also used of options struck on an unusual underlying asset or combination of assets.

Expected value (EV): The pay-off of an event multiplied by the probability of its occurring. For example, the probability of rolling a six on one die is 1/6 or 16.67%. The EV of a game in which one is paid $100 for rolling a six and nothing for any other roll is (1/6 x $100) + (5/6 x $0) = $16.67. EV is a key concept in option pricing, since the calculation of option value relies heavily on probability theory. The present value of the EV of an option will be the same as its premium if it is fairly priced. The EV of an option is a function of the size of two things: the relevant distribution of probabilities for the underlying asset price (itself determined by time of expiry and volatility) and by the location of the distribution versus he strike price (determined by the relationship between the strike and the current implied forward rate). The former establishes the range of possible outcomes, the latter defines the pay-off value of each outcome. See Black-Scholes, distribution, delta, lognormal distribution, premium, rho, theta, vega, volatility.

Exploded tree: See binomial model.

Exploding option: An option which is automatically exercised when the underlying reaches the strike level. Often used as one element of a

particular collar or risk reversal strategy in which as soon as the underlying trades through the strike price, the short option explodes (expires) and the long option pays out. See capped.

Extendible: Used of instruments whose life can be extended beyond an original term at the option of one or both of the counterparties.

/floater: An FRN, usually one-year, extendible to two or three years at the issuers option. For example, if the two-year swap rate were trading at 5.65% and the forward curve was implying rates of 7.5% an investor who wished to take a view against the pessimistic forward curve could buy a one-year extendible FRN under which he receives six-month Libor plus 50 bp for the first year. Then, if the two-year swap rate at the end of that first year is higher than 7.65%, the note will be extended a further two years and the investor's coupon would be fixed at 7.65%. Effectively the investor is selling a one-year option on the two-year swap rate at the forward rate (7.5%). If the investor had instead bought one-year paper paying Libor flat, the fixed reinvestment rate at the end of the year would have to be higher than 8% to outperform the extendible. See also index amortizing rate note.

/swap: A swap in which one counterparty has the right to extend a swap beyond its original term. Essentially therefore it is the combination of a vanilla swap with a swaption. Most commonly it is the fixed-rate payer who has the option. However, in the commodity markets, it is often the floating-rate payer. So an oil consumer who wishes to fix the price of his oil purchases can enter into a fixed-for-floating commodity swap under which he pays a fixed rate that is lower than the going swap rate and that is approximated his budgeted rate and in exchange grants the floating-rate payer the option to, say, double the life of the swap if the price falls below a certain point. If it does, the consumer is paying his budgeted rate and the option writer is benefiting from paying out a lower floating price than he is receiving fixed.

Extension swap: A forward start swap whose start date coincides with the termination date of an existing swap and which will automatically extend the original transaction.
Extrinsic value: That part of the premium that is not intrinsic value -- that is, the part of the value of an option made up primarily of its time to expiry, strike level and volatility.

F

Factor sensitivity: The impact on a derivative portfolio of movements in the underlying risk parameter of an individual product.

Fair: Of prices usually either the theoretical price an instrument should fetch or the no-arbitrage price.

/price: Of a future or forward contract, the price at which arbitrage between the derivative and the underlying asset just breaks even.

/value: Of an option, what the price of an option should be in an efficient market according to probability-type option models.

Fairway bond: See range **floating-rate note**
.

Fairway swap: See accrual swap.

Finite difference methodology: An option pricing approach that falls into the category of numerical models. It is based on finding a numerical

solution to the differential equation that the option valuation must satisfy. It does this by converting the differential equation into a series of difference equations which are then solved iteratively.

First generation structured **note**: Structured assets that generally contain only one **floating rate** index; where the maturity of the **floating rate** index must coincide with the reset and payment frequency -- eg three-month Libor coupons must be reset and paid quarterly; where the floating-**rate** index is of the same country as the currency of denomination (no quantization); and where no exotic options are embedded. In other words the index **rate** and discount **rate** of these **notes** are equal to each other and to the to-maturity Treasury **rate**. The commonest examples are FRNs; capped and floored FRNs; collared FRNs; inverse FRNs; superfloaters.

Fixed accrual **note**: A range **floater** with two fixed coupons, one payable if the underlying trades within the range and one payable if it does not. See range **floater**.

Fixed(-for)-fixed: Swaps in which both counterparties pay a fixed **rate**, a situation commonest in currency swaps.
Fixed(-for)-floating: Swaps in which a fixed-**rate** payment stream is exchanged for a payment stream referenced to a floating-rate index.

Fixed-rate payer: The swap counterparty that undertakes to pay fixed in a swap. Also said to be the buyer of or long the swap.

Fixed-rate reset swap: An interest rate swap in which fixed rate is reset at the cash rollover date.

Flex options: Exchange-traded options that allow the buyer to specify the style (American or European), strike, maturity, and notional principal of an option. This enables hedgers to eliminate the timing mismatch between hedge and underlying position that can occur with standardized exchange-traded product. They also avoid the gamma and vega mismatches which occur: for example, near-the-money options with a long time to run have high vega but little gamma whereas near-the-money options with little time to run have the opposite.

Flexi range floater: A range floater with a resettable range. At reset dates the buyer cab adjust the range to reflect any changes in their view. This new range must be the same width as the original. Because of this flexibility they pay lower coupons than vanilla range floaters. Nowadays these are usually structured with 100% principal guarantees and are either linked to a particular foreign exchange cross rate or an interest rate. Also known as a resettable range floater.

Flex(ible) swap: An interest rate swap under which the buyer receives a fixed rate and pays the higher of a lower fixed rate or Libor minus a pre-set spread.

Floating(-for)-floating: A swap in which both parties pay a floating rate. A floating-floating interest rate swap is known as a basis swap.

Floating-rate payer: The swap counterparty that undertakes to pay floating in a swap. Also said to be the seller of or short the swap.

Floating strike option: See moving strike option.

Floor: An option strategy that sets a floor on the holder's exposure to the underlying. In an interest rate floor, in exchange for a onetime upfront

payment, the floor seller agrees to pay the buyer the difference (if positive) between the strike rate and the current rate at pre-set times over the life of the floor. This establishes a minimum interest rate for the holder -- typically, a lender needing protection against interest rate falls. A floor can be constructed from a series of single-period puts on an interest **rate** index or a series of calls on an interest futures contract or zero-coupon bond.
/**rate**: The strike price of a floor.

Floor/ceiling swap: See collared swap.

Floored **floating rate note**: An FRN with an embedded floor below which the coupon cannot drop. This gives investors protection against lower short-term **rates** but, since they must pay for the floor, this is at the cost of a spread to Libor (or some other index) below that on equivalent FRNs. The risk for investors is that rising rates push the floors out-of-the-money, leaving them with a note that underperforms vanilla FRNs. Many of the instruments were launched with deeply in-the-money floors to provide higher than market yields.

They perform best in environments in which the yield curve is steeply positive but in which rates actually fell (1991-1993 for example). This makes the floors cheap to buy at the outset and then means that they move handsomely into the money. Investors who mark-to-market should note that these bonds, like all notes that contain options, are price sensitive to changes in volatility. They are also extremely sensitive to interest rate movements when rates are at the floor strike.

Floored put: A put option position whose maximum payout is limited either by the incorporation of a barrier which when hit causes the option to be exercised automatically or by the existence of another option.
Floorlet: The name given to one of the series of single-period options from which a floor is constructed.

Floortion/Floption: An option which gives the holder the right but not the obligation to enter into a floor at a predetermined strike and premium on a specified date.

Foreign exchange accrual **note**: A range **floater** in which the range is set by an upper and lower value for a specific exchange **rate**.

Forward contract: An agreement to buy or sell a given quantity of a particular asset (usually currency) at a specified future date at a preagreed forward price. A forward is the OTC equivalent of a future. The difference between the spot price and the forward price is largely influenced by the cost of carry, that is, for financial assets, interest rates. The theoretical forward price of a carryable asset like currency contains no expectations of the future spot price since the seller of the contract can hedge by holding the underlying. However they may contain expectations of future interest rates, because the seller has to fund that position. Forwards are not generally traded but, if unwound, the value of a forward contract prior to expiration is the difference between the forward price at which the contract was agreed and the forward price that subsequently prevails in the market.
Forward band: See collar.

Forward curve: See implied forward curve.

Forward exchange margin: See swap rate.

Forward exchange rate agreement (FXA): A form of synthetic agreement for

forward foreign exchange whose value at maturity is based on the difference between the forward rate on the start date and the spot rate at settlement.

Forward extra: A hedge position that consists of a vanilla FX option that becomes a synthetic forward contract if a trigger level (set out-of-the-money-forward) is reached at any time before the option expiry. For zero premium cost, the purchaser of the structure acquires protection for any adverse exchange rate move, at a rate that will be somewhat worse than the forward outright in exchange for the right to gain in a limited fashion from favourable moves in the spot rate provided that the trigger is not reached. If it is, then the hedger is obliged to transact at the unfavourable synthetic forward rate. For example, a hedger short dollars and long Deutschmarks at 1.5700 (forward 1.5673, volatility 9.8%) could buy a US$ call/DM put forward extra struck at 1.5700 with a knock in at 1.5150. The net premium cost of the position is zero. If the spot trades above 1.5700 at expiry then regardless of whether 1.5150 has or has not traded, then the underlying is hedged at 1.5700. If the spot is below 1.5700 at expiry, then if 1.5150 has not traded then the underlying benefits below 1.5700, but if 1.5150 has traded then the holder of the position is obliged to buy US$/DM at 1.5700.

The position is essentially a cross between an option and a forward, combining much of the certainty of the former with some of the flexibility of the latter. It provides protection while giving the potential to outperform the initial prevailing outright forward rate for no premium.

Forward-forward: In the foreign exchange markets, a forward sale/purchase of a currency against a forward purchase/sale. It involves the exchange of currency deposits.

/(interest) rate: An interest rate that will apply to a loan or deposit beginning on a future date and maturing on a second future date. For example, a 6s/12s forward forward is an interest rate agreement fixing the rate payable on a loan starting in six months time and maturing six months later.

Forward intrinsic value: The parity (intrinsic value) of an option plus the basis of the forward underlying it. In an efficient market a European option should not trade at less than its forward intrinsic value. FIV for a call is generally greater than the standard intrinsic value and less than it for a put.
Forward outright rate: The actual forward exchange rate used in a forward contract.

Forward point: The number added to or subtracted from the spot exchange or interest rate to calculate a forward price.

/agreement: A swap agreement in which one counterparty pays fixed foreign exchange or interest rate forward points, fixed at the outset of the contract, and receives actual floating forward points at a pre-determined date in the future. The agreements can be cash settled or physically settled by entering into the forward at the fixed points directly on the repricing date.

Forward rate agreement (FRA): An interest rate contract for difference under which buyer and seller agree to exchange the difference between the current interest rate and a pre-agreed fixed rate, struck on the date of execution of the FRA contract. If rates have risen, then at maturity the purchaser of the FRA receives the difference in rates from the seller. If they have fallen, the seller receives the difference from the buyer.

FRA prices are quoted as interest rates on the basis of the bid and offer

yield levels for the period of the FRA. The FRA rate itself is the implied forward rate for the relevant date. FRAs are labelled on the basis of the number of months to the start and end of the FRA. A three-month FRA starting one-month forward is a 1x4 FRA, a 3 v 9 FRA is trading the implied six-month Libor rate in three months' time. So if the 3 v 9 were trading at 6.90% and a corporate believed that in three months' time six-month Libor would be above 6.90%, then they would buy the FRA on their desired notional principal. Unlike interest rate futures, there are no up-front margin payments. FRAs are the building blocks from which swaps are constructed.

Forward rate bracket: A currency forward contract in which the buyer has limited participation in any favourable currency moves while retaining the downside protection of a standard forward contract.

Forward spread agreement: An FRA on the forward interest rate differential between rates in two different currencies (i.e. the spread between two FRAs in different currencies) applied to a nominal amount in one currency. The settlement amount is the difference between the current spread and the pre-agreed strike spread. This Diff FRA is the basic building block of a currency protected swap.

Forward (start) swap: An agreement to enter into a swap on a fixed future date at a prearranged price.

Fourchette option: French for fork option, a name occasionally applied to a number of types of options whose payout is contingent upon particular spread or range conditions being fulfiled.
Fraption: See interest rate guarantee.

Frequency density function: The height of the normal distribution curve at any point.

Frequency distribution: The distribution of the frequency with which the underlying asset changes price within a predefined period. Graphically, frequency is plotted against price change.

Front month (contract): The near month futures contract.

Futures contract: An agreement to buy or sell a given quantity of a particular asset at a specified future date at a pre-agreed price. Like forwards, futures differ from options in that they represent an obligation to buy or sell the underlying. Unlike forwards, they have standard delivery dates, trading units and terms and conditions. They are available on a wide range of financial and commodity assets, generally expire quarterly and can be cash or physically settled. Most importantly, they are traded on exchanges which act as counterparties to all transactions and which run margining systems. Margin is the collateral futures traders must set aside against their positions. First, an initial margin must be deposited with the clearing house on entering a trade. Thereafter futures positions are marked-to-market daily and a variation margin is paid/received to maintain the required level of collateralization. The role of the exchange and the margin system significantly limit credit risk.

G

Gamma (character omitted): Mathematically the second derivative of the option premium with respect to the price of the underlying, gamma measures the change in the delta of an option for a one-unit change in the price of the underlying. If an option has a delta of 0.49 and a gamma of 0.04, the delta would be expected to rise to 0.53 if the underlying moved one unit in price. (This relationship is made more complex because gamma itself changes with movements in the underlying).

Gamma is vitally important to anyone hedging a portfolio of options because it is an indicator of the frequency with which a delta-neutral portfolio should be rebalanced. A position which is delta neutral but which has a high gamma will quickly become bullish or bearish on the direction of the underlying asset price. This results in changes in the value of the option position that are not exactly offset by changes in the value of the underlying asset. This gamma risk can be hedged only by trading options -- using an option or position with a gamma of -G to offset an option or position whose gamma is G. Gamma is highest for at-the-money options, particularly those close to expiry, and decreases the further away from the money the option is. This is because small price moves around the strike have much larger effects on the probability of the option expiring in the money, that is delta, than they would if the option was deeply out-of-the-money. Gamma also increases as volatility decreases for an option which is at-the-money. This is because high volatility increases the likelihood that an at-the-money option will be either in- or out-of-the-money while low volatility means a decrease in this likelihood. In the latter case, since the probability of the option expiring in- or out-of-the-many will increase with greater dependency on movements in the underlying a higher gamma will result. The unusual relationship between gamma and volatility means that even positions which are delta and gamma hedged are exposed to the risk that they will become unbalanced because of changes in volatility. Gamma is sometimes called the convexity of an option.

/trading: The buying and selling of options to ensure gamma neutrality and so delta neutrality.

Gap option: An option that enables the holder to hedge against or benefit from dramatic movements in the price of the underlying. A gap option on Libor might pay out a certain amount if Libor rises by more than 50 bp in the next month. It therefore has two triggers, the gap trigger (50 bp) and the speed trigger (one month). Gap options are difficult to hedge because of their sensitivity to the rate of change of the underlying price.

Garch: Acronym for generalized autoregressive conditional heteroscedasticity (Arch). A variation of the pure Arch that generalizes the univariate Arch models into allowing the whole covariance matrix to change with time instead of just the variance. Several other variations exist. See Arch.

Garman-Kohlhagen pricing model: The classic and commonly used extension of the Black-Scholes option pricing model to pricing currency options. Mark Garman and Steven Kohlhagen showed that much the same arguments apply to pricing currency options as apply to pricing stock options with adaptations to allow for the two interest rates and the fact that a currency can trade at a premium or discount forward depending on the interest rate differential. (The dividend yield is replaced by the foreign interest rate). Binomial models are used alongside Garman-Kohlhagen to price American-style currency options.

Guaranteed exchange rate: see currency protected.

Geometric Brownian motion: Describes the movements in a variable or asset price when the proportional change in its value in a short period of time is normally distributed. The changes in two non-overlapping periods of time are uncorrelated, hence the alternative name for the process -- random walk. The term geometric refers to the fact that it is the proportional change in the asset price (not the absolute level) that is normally distributed. This means that the future value of a variable following geometric Brownian motion has a lognormal probability distribution and is

always positive, unlike a variable following a Wiener process, whose value can become negative. This makes it mathematically useful and consequently it is the most common assumption for the movement of stock prices, stock indices, currencies and futures contracts. It is the assumption made for stock prices in the original Black-Scholes options pricing model.

Geske-Johnson option pricing model: The Roll-Geske-Whaley model values call options on dividend-paying assets but is not applicable to American-style puts on such assets. Indeed there is no analytical solution. The Geske-Johnson model, an extension of the Roll-Geske-Whaley model, notes that there is a positive probability of early exercise of in-the-money puts which means that an American-style option can be viewed as an infinite sequence of options to exercise a European-style option. However, when the put is on an asset that pays dividends, the valuation procedure is simplified because it will not be optimal to exercise prematurely the option at any time near to but prior to an ex-dividend date. Because of its complexity, it uses trivariate normal density functions. Many market practitioners use binomial models instead.

H

Heath-Jarrow-Morton: A two-factor term structure option pricing model that uses all the information in the term structure and can handle multiple causes of term structure movement. This means that the returns on zero-coupon bonds of differing maturities are not assumed to be perfectly correlated (as is assumed, for example, by the Ho-Lee model).

The two factors or inputs into the HJM model are an underlying (in this case the entire term structure which is an input into the model in the same way that the current stock price is an input into Black-Scholes) and volatility -- that is, a description of how the term structure fluctuates over time. This means that the model does not have to assume that all bond prices (in fact the model uses stochastic forward rates not zero coupon yields) are perfectly correlated. Instead, it assumes a random term structure of interest rates and is designed to be automatically consistent with both the observed term structure and the volatility functions input by the user. As a result of using a multi-factor model of the term structure, the model employs a multinomial instead of binomial model of term structure movement.

The key difference between it and the spot rate models of Black-Derman-Toy, Vasicek, Hull-White and Cox-Ingersoll-Ross is that these models treat the spot interest rate as the underlying variable. Besides the current spot rate, these models include various parameters used to describe the possible future paths of the spot rate. Since the current term structure is not a direct input, these models try to fit the term structure by searching for parameter values which cause calculated zero coupon bond prices to match the market.

Hedge: To offset the risks of one position by taking out an opposing position at the expense of potential reward.

Hedge-ratio: See delta.

Heteroscedastic: In simple linear regression, an error term compensates for the fact that in modelling the relationship between two variables, one of which is assumed to be the major factor in the movements of the other, movements in one will in fact be imperfectly described by movements in the other because of factors not captured by the regression model. This error term is normally distributed with a mean of zero and a constant variance so that its effects cancel each other out. If the spread of error terms is constant, it is said to be homoscedastic. If it is not, it is said to be

heteroscedastic. See Arch.

High-coupon swap: A swap whose fixed-**rate** payments are above the market **rate**. The **floating-rate** payer may compensate the fixed-**rate** payer either by higher periodic payments or by payment of an upfront fee.

Hi-lo **floating-rate note**: a capped **floating-rate note** that pays a reference **rate** plus a significant spread until the cap strike is hit when it becomes a reverse **floater**.

Hi-lo option: An option which pays out the difference between the high and the low price or **rate** reached by the underlying over the term of the option. Constructed from a combination of a lookback call and lookback put, the buyer is taking a view that the volatility of the underlying will be greater than the implied volatility of the component options.

Historical volatility: The volatility in the underlying's price, rate or return over a specified period in the past, usually measured as the standard deviation of the natural log of the underlying price relatives. It is used as an indicator of future volatility and to check whether the implied volatility of an option is expensive standards.

Ho-Lee: The first whole-term structure option pricing model, proposed by Thomas Ho and Sang-Bin Lee in 1986. Using a discrete-time binomial approach this single-factor model incorporates the whole term structure rather than just changes in a long or short interest rate. Thus given the term structure as known today, in the next time period the whole term structure can move up or down. However, the model makes a number of assumptions not borne out by empirical observations: it assumes that the returns of zero coupon bonds of different maturities (which it uses to represent the term structure at each node on the binomial lattice) move in a perfectly correlated manner and it requires that all interest rates both spot and forward have the same volatility. It also allows for negative interest rates as it does not incorporate mean reversion. Unlike Black-Scholes-type models, Ho-Lee establishes no explicit link between hedging and pricing.

Homoscedastic: See heteroscedastic.

Horizontal spread: The simultaneous purchase of one type of option (call or put) and sale of the same type of option with the same strike price but a shorter maturity. This trade will profit if the time decay on the short position is faster than that of the long. See diagonal, vertical spread.

Hull-White pricing model: A single factor model developed using a trinomial lattice. It is a yield-curve based model in the same mould as the Ho-Lee, Vasicek, Heath-Jarrow-Morton and Black-Derman-Toy models. A key feature of Hull-White is that it treats mean reversion as time-dependent.

Hybrid: An instrument whose returns depend on a combination of risk types or which has been constructed from several different instruments to produce returns which mimic those of another instrument.

/derivative: A derivative product incorporating two or more different risk types.
The commonest types are hybrid  barrier caps and floors. Hybrid knock-in caps usually link foreign exchange rates and interest rates. For example, a Japanese exporter with large floating-rate debt outstandings might be very profitable when dollar-yen exceeds 105 but below 95 cash flow becomes critical and he requires interest rate protection. A normal five-year 7% cap might cost 364 bp. Instead they buy a five-year 7% cap which knocks-in

when the dollar-yen rate hits 95. This reduces the cost of the cap by 160 bp. Hybrid knock-out caps are useful for commodity producers. For example a gas producer's profits usually rise with rising gas prices but fall with rising interest rates.

The company's nightmare is the combination of rising rates and falling prices. It could buy a standard cap, but is unwilling to pay so much in premium because it is really only the combination of factors that pose a threat. It does not want straightforward and expensive interest rate insurance. Instead the company can buy an interest rate cap that is knocked-out if the gas price exceeds a specified barrier in any quarter.

The strike and knock-out levels are set at the company's combination pain or breakeven threshold. The company pays floating interest rates only when it has profits with which to pay.

The knock-in or knock-out can be tied to almost any underlying index. For example, a UK-based company might wish to buy interest rate cover for some debt. However, it is contemplating floating off a large subsidiary in the next two years in which event it will not require the cap. Instead of buying a three-year cap at a cost of 339 bp, they buy a knock-out cap that knocks-out when the FTSE midcap index rises by 15%. This cap costs 140 bp less. As well as the lower premium, the cap will disappear at exactly the right time: when the company will be able to float its company or sell it at an attractive price and pay down its liabilities. The knock-out can either be permanent, as in these examples, or the cap can be structured so that it is only knocked-out for the period in which the outstrike is breached. If the underlying moves back through the outstrike, then the cap is reactivated, making it resemble a range transaction.

Hybridization has also been applied elsewhere -- for example a semi-fixed swap with the rate reset trigger dependent on the price of oil (a swap plus a binary oil option). See N-cap.

/security: In the context of derivatives, any complex security containing embedded swaps or options. Elsewhere, a security that combines the return, balance sheet and/or tax characteristics of both debt and equity.

I

Impact forward: A collared forward, usually constructed so that the purchase of the put option is financed by the sale of the call.
Implied correlation: The correlation component of the price of an option on two or more underlying assets. Multi-factor models can take historical correlation as an input or it can be reversed out of them if they are provided with the option price.

Also, less scientifically, the difference between the prices of otherwise identical first- or second-order correlation products given by different banks. For example, a spread option or outperformance option (both first order correlation products because their prices depend directly upon the correlation of the two underlying assets) may have the same maturity, strike and volatility but be priced differently by two different institutions.

One reason for this difference could be differing views on that correlation. If an option provider believes that the volatilities of the underlying assets are more closely correlated than recent historical spread volatility implies, he will price a spread option below the level chosen by someone with the opposite view, as a higher correlation means less risk and so fewer hedging costs.

In practice though, most providers post a wide bid/offer on such products, implicitly pricing in a high correlation on the bid and a low correlation on the offer. Implied correlation can also be stripped from currency options because these are options on a pair of assets not a single asset. The lower the volatility of the cross relative to the volatility of the individual components, the more highly correlated the two exchange rates.

Implied forward rate: A forward interest rate that can be implied from the par or zero coupon yield curves.

Not only do the expectations embedded in the yield curve indicate what the yields on varying maturities of fixed-income instrument should be, they contain all the information needed to calculate, say, the one-year rate in one year's time from the two-year rate.

The implied forward rates are calculated from the incremental period return in adjacent instruments on the zero curve or on the swap curve, since swap rates are mathematically equal to the weighted average of all FRAs. (NB: FRAs are determined from implied forwards, not vice versa.) These implied rates are not necessarily those forecasters believe will materialize, they are simply the rate that financial instruments 'predict'.

So, if six-month Libor is 5.00% (180 days) and three-month Libor is 4.00% (90 days) the implied rate for three-month Libor in three months' time must be 6.01%, since this rate satisfies the condition that an investor/borrower would be indifferent between receiving/paying 4.00% for three months and reinvesting/rolling over at 6.01% for a further 3 months, and receiving/paying 5.00% for three months.
The curve plotted by these rates, known as the implied forward curve, is steeper than the yield curve. That is, when the yield curve is positive, forward rates are implied to be higher than spot rates and in a negatively sloped curve forward rates are implied to be lower. The implied forward curve is crucially important since derivative products are priced off it, rather than the spot rate (even if they are struck with reference to the spot.) Therefore by definition, when using derivatives to profit from a market view, treasurers and investors must first compare their view with the implied forward. If they are the same, there is no opportunity to profit from a view. All speculative views on the market are only profitable if they differ from the implied forward.

A number of derivative instruments have been devised that modify the payout from their vanilla versions by allowing users to take advantage of a view that differs from the implied forward, for example the Libor in arrears swap.

Implied repo rate: The short-term financing rate that will make a cash-and-carry arbitrage involving the cheapest-to-deliver bond break even. That is, a rate is equal to the return earned by buying the cheapest-to-deliver bond for a bond futures contract and selling it forward via a short position in the futures contract.

Implied volatility: The value for volatility embedded in the market price of an option. Since option pricing models normally require an input for volatility derive an option's price, they can use the market price of the option to derive the level of volatility implied in it. This represents the market's best estimate of future volatility and can be compared with historical volatility to determine whether this view has changed. In general, the higher the implied volatility, the higher the price of the option. Many option prices (particularly foreign exchange options) are quoted in volatility terms.

In-option: A barrier option which becomes a conventional option for its

remaining life if the price of the underlying reaches a pre-set trigger price. Also called a knock-in. See barrier option.

In-the-money: An option is in-the-money if it has intrinsic value because the market price of the underlying is above (below) the strike price of a call (put). If an option is struck in-the-money, its strike price is more favourable than the implied forward rate or price prevailing. An in-the-money option has a delta greater than 0.50, an at-the-money option has a delta of 0.50 and an out-of-the-money option has a delta of between 0.00 and 0.50, though exotic options have more complex delta characteristics as they behave like bundles of options. See delta.

Incremental fixed swap: A pay-fixed swap in which the fixed-rate is only payable on a certain percentage of the notional of the swap -- the rest staying floating. The fixed portion of the swap increases with Libor according to a pre-set ratchet table. Because the IFS swap rate is not always paid on the full notional amount, it is much higher than vanilla swap rates. The IFS therefore appeals to floating rate borrowers who believe that rates will stay considerably below the level at which the fixed rate is payable on a large proportion of the notional principal (which would push the blended rate well above swap rates. The IFS therefore performs a similar function to an interest rate cap, in that it fixes a maximum cost of funds, but instead of paying an upfront premium, users pay for the insurance against catastrophic rate rises in the form of a higher swap rate. Also known as an index fixed swap, self-regulating swap. See blended interest rate swap, semi-fixed swap.

Index amortizing note: A note which mimics the performance of mortgage-backed products by amortizing according to a pre-set quarterly schedule that is linked to the level of a specific index, usually Libor or the PSA. As market interest rates increase (or prepayment rates decrease) the slower the notes amortize, and so the longer their average life. In this respect they behave like collateralized mortgage obligations (CMOs).

In some cases the amortization is all or nothing: after the first year the notes will be called in their entire if Libor has not risen by, say, more than 100 bp from the current level. The notes' coupon is fixed, and for the first year there can be no amortization. The coupon is set significantly higher than the prevailing yield on one-year notes. The investor is taking a view that future sharp rate rises predicted by the steep forward curve will occur. If they do not, then the note will amortize quickly (or be called after the lockout period) and he will obtain a higher yield then on a vanilla FRN of the same life. The risk is that rates do rise quickly and the notes' average life extends, leaving the investor with a coupon fixed at levels that become more unattractive with every new rate rise. The notes behave oddly on a mark-to-market basis. In low interest rate environments interest rate volatility makes extension more likely and so pushes down the value of the notes. In high interest rate environments high volatility means a higher probability of lower Libor and so of amortization and a higher value for the note.

Index-amortizing rate swap (IAR): The commonest type of indexed principal swap (IPS), differing from the generic IPS in that the notional principal can only amortize. The IAR is a fixed-for-floating swap whose notional principal drops over its life as interest rates change (usually fall).

Originally these instruments grew from the mortgage swap market and the amortization schedule was designed to correspond to the expected timetable of prepayments on a pool of mortgages but now almost any amortization schedule is possible by agreement.

Typically one counterparty receives an above market fixed rate and pays a

floating rate on a notional principal amount that amortizes at a rate determined by a chosen index. The fixed-rate receiver obtains this high coupon because he has effectively sold the fixed-rate payer an option to shorten the swap's life if rates move against him. The notional principal is generally fixed for an initial two-year period of the swap, known as the lock-out period during which time the buyer is protected against amortization. After that period, the notional amount of the swap will decrease as a function of the level of the index chosen.

Sample terms might state that if Libor remains below 5.0%, the swap will amortize completely. If it stays between 5.0% and 5.5% the swap amortizes by 75%. If it rises to between 5.5% and 6.0% the swap amortizes by 50%. Between 6.0% and 6.5% it amortizes by 25%. And above 6.5% the swap notional remains at 100%. The swap's maturity date is the point at which any remaining notional principal outstanding matures. And there is generally a clean-up feature: if the notional principal falls below 5% of the initial notional amount, the swap amortizes completely.

Originally, this type of swap appealed to investors who could link the amortization with indices of mortgage prepayment rates to create off-balance sheet investments that behaved like collateralized mortgage obligations.

This concept was then extended and used by more adventurous treasurers who wanted yield enhancement on their short-term cash investments in particular yield-curve environments. Instead of investing in, say, vanilla one-year paper, the treasurer can maintain three-month rolling assets at Libor flat and pay that floating stream into an index amortizing swap with a one-year lock-out and a final maturity that represents the maximum period for which he is comfortable locking in his funds. As Libor decreases, the amortization speeds up.

For the lock-out period, the treasurer earns an above-market rate on his assets. In return for this, after the lock-out period he accepts that, if Libor declines, instead of benefiting from paying less into the swap and receiving fixed on the full notional amount, the swap will amortize, forcing him to reinvest the freed-up cash at lower rates.

These swaps are usually structured so that as long as the amortization falls in a range between zero (the swap matures on the full original notional amount) and 100% immediately after the lock-out period, the treasurer achieves an above-market yield as well as a flexible medium-term investment vehicle. Because amortization is expected, the swap performs rather like a money market instrument after the lock-out period and provides cash liquidity as it amortizes. The swap works best in a steep yield curve environment.

Finally, the liability management potential in a steep yield curve environment became clear. If the treasurer believes that short rates will not rise by more than, say. 100 bp in the next two years, an alternative to the vanilla swap is the index amortizing swap. For the two-year lock-out period, the floating rate that the treasurer must pay into the swap can be up to 50bp less than he would have to pay into a vanilla swap of the same maturity. Second, after the lock-out period, the notional principal on the swap will amortize 50% as long as Libor does not rise more than 100bp, so that the treasurer's net position -- existing liability plus swap -- reverts gradually to a fixed-rate liability.

The transaction makes sense in yield-curve environments where the blended rate created by the transaction is cheaper than the vanilla swap for the full term of the liability, a vanilla swap for part of the remaining life of the liability or a cancelable swap.

The danger is that the treasurer's prediction that Libor will rise no more than 100bp might be significantly mistaken. If the rise is severe enough, no amortization will be triggered and the treasurer will have to remain a floating payer for the remaining life of the liability. However, this floating rate will still be less than that payable under the vanilla swap.

IARs -- or rather the fixed-rate pay side of an IAR -- has positive convexity through the effective sale of an embedded option that triggers amortization of the swap if interest rates fall. This means that are popular as a way of offsetting the negative convexity of mortgage-backed securities which are affected by prepayment when rates decline. Most have had maturities of less than three years to maximize the amount paid on the fixed leg. See blended interest rate swap, incremental fixed swap, index principal swap, Libor regulating swap, semi-fixed swap.

Index fixed swap: see incremental fixed swap.

Indexed strike caps: An interest rate cap whose initial strike price is reset upwards if interest rates rise the rough a pre-set trigger level. For example a 7.50%/8.50% indexed strike cap with an index strike of 9% will behave like a 7.50% cap as long as rates stay below 9%. If they reach 9% then it will reset and behave like an 8.50% cap.

Indexed principal swap (IPS): A fixed-for-floating swap whose notional principal can accrete or amortize according to a predefined index, such as Libor, CMTs or a mortgage prepayment index such as PSA rates. The fixed-rate payment is higher than would be payable on a swap with a fixed notional principal and the amortization rate generally decreases when rates rise and increases when they fall. The commonest type is the mortgage replication swap. The commonest types of IPS have a notional principal that can only amortize and which amortizes more quickly as rates fall. These are known as index amortizing (rate) swaps (IARs). If their notional principal amortizes faster as rates rise, they ore known as reverse indexed principal swaps. In the latter case the swapper gives up yield in exchange for the desirable characteristic of positive convexity. Most IPSs and IARs have a clean up feature: if the notional principal falls below 5% of the initial notional amount, the swap amortizes completely.

Installment option: An option paid for by instalments at regular intervals. The purchaser can elect not to make a payment, in which case the option is terminated. The holder effectively has a string of extendible calls on a put. They are more expensive than standard options but only by the financing costs of the premium and only if all payments are made. Also known as a rental option since if the holder misses a payment, the option is repossessed. Useful where protection is required (put) but market view is bullish. Protection can be terminated before full payment has been made. However, total premium is more expensive than for a standard option if all instalments are paid.

For example, a company might have sold a three-year **floating-rate note** that the buyer can put back under certain circumstances. In return for this embedded option, the company receives a significant discount on its coupon payments. The company is not very happy with the interest rate outlook and thus want to hedge this floating rate exposure. A normal three-year quarterly cap with a 7.35% strike would cost 174 bp. However, should the loan be called, the interest rate hedge will no longer be required. They therefore decide to enter an installment cap which would cost 23 bp per period (the rental payment). The company can simply terminate the cap when desired by ceasing to make installment payments. This scenario can be of use when the underlying note gets called, or when it the company decides it no longer requires the protection of the cap.

The price of the option will depend on the termination date of the option and so the number of installment payments made. If used for the whole original maturity it will be more expensive than an vanilla option. Also known as an installment option, rental option. See contingent premium option, deferred premium option, mini premium option, part contingent option, pay-as-you-go option.

Instrike: The barrier price of an in-option.

Interest rate basket option: An option on a basket of interest rates designed to reduce overall interest costs across a number of different markets. For example, a borrower may believe that his European interest rate bill would rise more than is implied in the market but is unwilling to fix in case his view is incorrect. Instead of purchasing a series of options on the individual market, he wants an basket because the mix of Northern and Southern European currencies exhibit some negative correlations that will reduce the premium cost. He could buy a one year 8% strike basket option denominated in his base currency with the underlying the average two-year swap rate in the chosen currency. If the average rate rose above 8% this hedger would be protected. The sensitivity of the basket would be similar to that of a basket of payer swaptions. (An investor would buy the product if he wanted a customized, balanced exposure to a region and is prepared to accept a degree of upside limit.)

Interest rate guarantee: An option on an FRA giving the holder the right but not the obligation to purchase an FRA at a predetermined strike. A cap can be thought of as being constructed from a string of interest rate guarantees. Also known as a fraption.

Interest rate swap: An agreement between two counterparties to exchange cash on a notional principal sum which is not exchanged. The commonest structure is the fixed-for-floating swap in which one counterparty agrees to pay a fixed rate over the term of the swap in exchange for a floating-rate payment payable by the other counterparty.

A typical hedging application would be a corporate treasurer with $ 1 billion of US dollar outstanding floating rate debt who believed that dollar interest rates were set to rise. To increase his level of fixed-rate debt and protect himself against rate rises, this treasurer could enter into a fixed-floating semi-annual swap on $500 million notional principal under which he would pay a fixed rate (the swap rate) and receive a floating rate lined to an index such as Libor. Every six months, a net interest payment is made between swap counterparties. If the prevailing level of dollar Libor is higher than the fixed rate (the swap rate) then the swap counterparty pays the treasurer the difference. If the swap rate is higher than Libor, the treasurer pays the counterparty the difference. This netting process fixes the treasurer's interest rate.

The swap can be reversed at any time. The unwind valuation is the difference between the present values of two sets of cashflows: that of the future cash flows payable/receivable under the swap and that of the cash flows for a matching but offsetting swap.

The market is effectively buying the right to continue the swap on its original terms. If these are better than the current terms then the swap has positive value. On a five-year swap that had run for one year, the comparison would be with a current four year swap. If the implied forward curve had shifted up sufficiently for the current four-year swap rate to exceed the original five-year swap rate, then the swap would have positive value as the market would be able to buy the (now higher) stream of Libors for the old (lower) price. The vanilla fixed-for-floating interest rate

swap is also sometimes called a coupon swap since it can be viewed as swapping the coupons from two bonds with the same principal. A swap, viewed from the pay fixed side, can be considered either as a portfolio of FRAs all with the same strike or as a portfolio which is short a coupon bond and long an FRN or, alternatively, as the combination of a cap and floor with the same strike.
Swaps are actively traded and are generally quoted on a yield basis, that yield being the yield to maturity that equates the present value of the fixed side to that of the floating side. Quotes generally refer to the fixed leg or coupon. So, for example, a five-year dollar swap quoted at 60 bid 65 offer means that a counterparty wishing to pay fixed and receive Libor flat would have to pay the marketmaker a fixed rate which is 65 basis points over the yield to maturity of the five-year US treasury at the time the swap is initiated. If he wanted to pay Libor and receive fixed, the counterparty would receive a fixed-rate of 60 bp over. So, the swap bid is the price at which a counterparty will "buy" a stream of Libor-linked cash-flows and the offer is the price at which they would "sell" a stream of Libor-linked cashflows.

Swap pricing depends on the term structure of interest rates, the swap spread, transaction costs and credit risk. There is generally no upfront premium for a swap, as at the outset of the swap both parties are theoretically indifferent as to whether they are in fixed or floating: the net present value of the two payment streams is zero. Since the price of an interest rate swap is the level at which the market is indifferent between paying a fixed rate or interest and a stream of Libor, it depends entirely on the implied forward Libor rates. This means that a hedger must, before he decides to fix, determine whether he believes rates will rise as far as the implied forward curve implies. In other words, if a treasurer is paying Libor + 50bp on a five-year loan, he can only swap this into the five-year swap rate plus 50bp. He cannot simply fix at current spot rates. In steep yield curve environments, where the implied forward curve is even steeper, fixing will incur significant negative carry. Entering into swaps without any underlying asset or liability position, or putting on swaps whose notional principal amount exceeds any underlying position is generally regarded as speculation though clearly switching from fixed to floating does itself imply some form of view taking on interest rates.

Intrinsic value: The amount by which an option is in-the-money and so the cashflow that the holder would realize if he exercised it.

Inverse floater swap: An interest-**rate** swap under which one counterparty pays fixed and receives a **floating rate** indexed negatively to a reference index such as Libor. As Libor rises, the fixed payer would receive less; as it falls, he would receive more.

Inverse **floating rate note**: An FRN whose coupon rises as a **floating** reference **rate** falls and whose coupon quickly declines in a rising **rate** environment. A typical coupon is calculated as a fixed **rate** minus a **floating** reference index. An example might be 7.5% minus three-month Deutschmark Libor. The **notes** generally contain a proviso that the coupon cannot become negative. This means that investors have purchased a cap whose strike is set at the level of Libor that will produce a zero coupon -- that is, it is struck at the fixed rate element. If rates rise beyond this strike, producing negative coupons, then the long cap makes up the difference back to zero. The notes suit investors who wish to obtain a high initial yield in an upwardly sloped yield curve and to benefit if rates fall. It is another structure that allows investors to bet against the occurrence of the rates implied by the forward curve -- an expression of the belief that although the yield curve implied higher forward rates in future, the underlying economy implies the opposite.

Investors should note that in this type of FRN, Libor resets in a rising rate environment will cause the bond to fall in value, not to reset its value to par and once the coupon is zero, the bond will trade at a discount with the duration characteristics of a zero coupon bond.

The inverse floater is constructed synthetically from an FRN and an interest rate swap of twice the notional size and leveraged further by increasing the amount of the swap.

Variants of the structure include a step-up constant (7.5% minus three-month Libor for the first six months, 8.5% minus three-month Libor for the second six months and so on) and also a fixed above-market first coupon followed by the inverse formula. **Notes** may be denominated in one currency and indexed to Libor in another (quantized). Also called the reverse **floating-rate note**.

**Interest**-only strip (IO): A **security** whose cashflows are derived only from the **interest** element of the underlying bond from which they have been stripped. The commonest varieties are stripped either from fixed-rate government bonds. Because they are effectively zero coupon bonds with a maturity and duration equal to the time to the coupon payment they represent, they are more sensitive to movements in interest rates than the underlying bond. Those stripped from mortgage bonds are different. They accompany POs, have no principal value and are sold at a deep discount to a notional principal amount which is used to calculate the amount of interest earned. The IO tranche only pays interest on the remaining PO balance that accompanies it. Heavy mortgage prepayments reduce the PO tranche to zero and so end the lives of the IOs. This means that mortgage IOs have substantial negative duration -- they rise in value as rates rise -- and are useful as a way of lowering portfolio duration in times of rising rates without selling securities at a capital loss. However, their option-like characteristics (the deeply discounted price of an IO is like the premium for a call option on rising or stable rates and, like an option, if rates fall, the IO can expires worthless) and their illiquidity make them unsuitable for most portfolios. IOs and POs are often called mortgage derivatives because of these option-like characteristics.

Investor's choice FRN: A **floating-rate note** that pays a conditional coupon. Investors are asked to guess the level of Libor in the upcoming period. If their guess falls within a predetermined range, then they receive an above market coupon. If it falls outside the range, they receive nothing.

J

Joint option: Quantos freeze exchange rate exposure and thus any upside gain. Joint options hedge both forex and underlying exposures allowing forex upside gain if the investor's currency strengthens. See linear forex swap.

Jump diffusion process: The process proposed by Robert Merton whereby the price of the underlying neither simply jumps nor follows a pure diffusion process but moves by a combination of a jump followed by continuous diffusion. Option pricing models have been extended to incorporate these kinds of jump price dynamics with directional bias but there are still theoretical problems associated with jump diffusion models. For example, the underlying asset in a foreign exchange option is an exchange rate which can be denominated in either of two currencies. However, jump diffusion models do not give the same prices when compared in a common currency.

Jump process: A stochastic process for movements in the price of the underlying proposed by John Cox and Stephen Ross. In it the price of the

underlying does not follow the pure diffusion process assumed by the Black-Scholes model but rather jumps from one point to another in steps larger than traditional random processes would generate. This idea was expanded in the Cox-Ross-Rubenstein binomial model.

K

Kappa (Character omitted): The effect on option premium of small changes in the short-term discount rate. Also used in the US for what is more commonly known as the vega of an option.

Knock-in: See barrier option, hybrid derivative. Also known as an in-option.

Knock-out: See barrier option, hybrid derivative. Also known as an out-option.

/with rebate: a knock-out option that makes a small payout to the buyer if it is knocked-out and becomes worthless.

Kurtosis: Specifically, the sharpness of a peak on a curve of a density function especially in comparison with that of a normal density with the same variance. More generally, a measure of how fast the tails of a probability distribution approach zero relative to a normal distribution. The extent to which the kurtosis of actual price distribution differs from that of the normal distribution is important in pricing and trading options. Models which do not take kurtosis into account will misprice options. Also, traders can take views on kurtosis. For example, those who consistently sell strangles are implicitly betting that the market has overestimated the kurtosis of the true probability distribution.

The complex payoffs of some exotic options can be viewed as bets by their purchasers that the actual probability distribution of the underlying is different from the normal or slightly modified normal distribution the marketmaker uses to hedge his book against outright moves in the underlying.

For example, the buyer of an up-and-out call does not believe it likely that the underlying will reach the knock-out level. He has created his own skewed probability distribution. According to the marketmaker's normal distribution, the probability that the knockout will be hit is considerably higher than that assumed by the investor's personal distribution, so the marketmaker will sell the knock-out call more cheaply than the standard call.

/coefficient: The measure of kurtosis. A kurtosis coefficient less than that of a normal distribution indicates a distribution with a fat midrange on either side of the mean and a low peak -- called platykurtotic (broad tailed). A kurtosis coefficient greater than that of a normal distribution indicates a high peak, thin midrange and fat tails -- called leptokurtotic. The latter is commonly observed in financial price and rate data.

L

Ladder option: A path-dependent option whose strike price is periodically reset when the underlying trades the rough specified levels. Some ladder options reset in both directions, others only in one direction. These options are useful not only for investors but also defensive corporate treasurers who do not like the inflexibility of European-style options but who do not want to have to worry about the theory of the optimum time to exercise American-style options. So a ladder call on the dollar-Deutschmark rate with a strike of 1.65 might reset the strike every five pfennigs up to

a maximum of 1.80 and have a payout of the greater of (i) the closing spot less the original strike and (ii) the highest rung reached less the strike. So, every five point gain is locked in and the strike is reset to that rung. If the rate then falls back, the gain remains locked in, but the strike is reset. The more frequent the resets, the more like a lookback option it is. Other ladder options have only a minimum settlement level: once the underlying has risen by, say, 10%, that gain is locked in regardless of the future path of the underlying price. If it subsequently rises above 10%, the investor still participates, but he also has a floor at 110. In exchange for this downside protection the maximum return is generally capped. A ladder call option can be viewed as a call struck at the ladder option's strike price, plus a series of bought knock-in put options each struck at a ladder level and a series of sold knock-in puts with strikes staggered one rung behind the purchased options.

For example, a ladder option on an index struck at 160 with a final rung at 175 would involve the purchase of knock-in puts struck at 165, 170 and 175 and the sale of knock-in puts at 160, 165 and 170. If the index went to 175 and then back to 160 the investor would be due the 15 profit. This is produced by the 30 points of profit from the long positions less the 15 points of loss from the short positions.

Lambda (Characters omitted): See vega.

Least squares regression: One of a number of types of regression analysis that measure the relationship between variables.

Lender option: A floor on an FRA.

Leptokurtosis: See kurtosis.

Level payment swap: An interest rate swap that converts the cash flows from an amortizing debt instrument or index into a fixed-swap payment.

Leverage: The ability to control a large nominal amount of an underlying asset with a relatively small amount of capital. Futures and options are leveraged because with relatively small downpayments (of margin or premium) the buyer gains exposure to large amounts of the underlying. See gearing, elasticity.

Leveraged: When used of derivatives or structured notes 'leveraged' indicates that the instruments' payoff formula includes a multiple of some underlying index or asset price. In general this is achieved using embedded swaps or options whose notional principal is greater than the nominal principal of the bond.

The written agreement between Bankers Trust and the New York Fed in the light of the corporate losses of, among others, Gibson Greetings and Procter & Gamble defines leveraged derivatives transactions (LDTs) much more broadly as "a derivative transaction (i) in which a market move of two standard deviations in the first month would lead to a reduction in value to the counterparty of the lower of 15% of the notional amount or $10 million and (ii) for notes or transactions with a final exchange of principal, where counterparty principal (rather than coupon) is at risk at maturity, and (iii) for coupon swaps, where the coupon can drop to zero (or below) or exceed twice the market rate for that market and maturity, and (iv) for spread trades that include an explicit leverage factor, where a spread is defined as the difference in the yield between two asset classes." This definition means the reclassification of may previously plain vanilla transactions as LDTs.

/capped **floater**: A **floating rate**

**note** that behaves like a normal FRN when Libor (or another index) is below a predetermined strike. Once the index rises above that strike, the **note** behaves like a leveraged inverse **floating rate note**. So the schematic coupon is: Libor + a if Libor < strike; B - m x Libor if Libor > strike. The equivalent investor position is long an FRN, short (m + 1) Libor caps at the initial strike, and long (m) Libor cap options at the higher strike. (Where m is the leverage factor). A typical actual formula might be the minimum of Libor + 30bp and 28.45% less (3 x Libor). These instruments work best in a steeply positive yield curve environment: in that case the caps are priced off the even steeper implied forward curve (and so raise a large amount in premium) and Libor has to move significantly above implied forward rates before the investor's guaranteed pickup is threatened by the formula. The enhanced leverage means that the coupon is extremely sensitive to rising rates and the coupon rapidly drops to zero once the strike level has been exceeded. Such instruments are normally floored to prevent coupons from becoming negative.

/bond: A general term used to describe any bond or note whose payout to investors is determined by a formula that is based on a multiple of the increase or decrease in a specified index such as Libor. For example, a coupon of 1.5 x 10-year CMT + 150 bp would be leveraged while one of 0.5 x 10-year CMT + 250 bp would be deleveraged as the multiplier is less than one.

/diff floater: A combination of a leveraged FRN with a differential swap. A typical example would pay 2 x (three-month Deutschmark Libor minus three-month dollar Libor) minus a spread. Again, to prevent negative coupons, floors are usually incorporated. Because of the quanto element of the **note**, these have to be cross-currency options.

/**floater**: An FRN whose coupon rises as **rates** rise but in a ration greater than 1:1. For example, a leveraged FRN might pay a coupon of 2 x (six-month Libor - 7.09%). The coupon is floored at zero. The investor is effectively long an FRN of twice the notional principal of the leveraged floater and short a fixed-rate bond whose coupon is the fixed-rate element of the formula. The investor is also long floors to prevent negative coupons. The two-times leveraged floater is the mirror image of the inverse floater.

/inverse floater: An inverse FRN whose coupon, instead of moving one for one with the reference index, multiplies the effects of any movement several times. So, for example, a leveraged inverse floater might have a coupon such as 12.5% - [2 x (Libor-6%)]. In this case, for every 1% fall in Libor, the coupon of the bond rises by 2% and for every 1% rise in Libor the coupon falls 2%. Since a standard inverse floater is created from an FRN combined with a swap of twice its notional principal, this structure uses a swap of four times the notional principal. The coupon is floored at zero -- though the investor has actually bought interest rate caps whose strike is set such that the investor is compensated for rate rises that push the coupon below zero and make up the difference.

Inverse floaters have become somewhat notorious in the US because of their association with the mortgage-backed market. Floating-rate CMOs and mirror companion inverse floaters sustained heavy losses in the interest rate rollercoaster of the last 12 months. Because the floater + inverse floater package must equal the underlying pool of fixed-rate mortgages they are backed by, the floaters carry a maximum interest rate which is dictated by the zero floor on the inverse floaters. In other words the floaters are short the cap embedded in the inverse floaters. Failure to value or appreciate the effects of this also led to significant losses on the floaters.

/swap: A swap in which the fixed-rate receiver receives an above-market fixed rate and pays a multiple of the floating rate index. Although leveraged swaps have hod a very bad press in the light of the corporate losses of 1994, it is worth pointing out that such swaps are little different from vanilla transactions. For example, a hedger/investor who believes that the future spot rate will be lower than the rate implied by the forward curve can simply receive fixed and pay floating under a swap. To make this more speculative, he can transact such a swap on twice the notional principal of his liabilities. If he is constrained by internal guidelines on notional principal, he can substitute a leveraged swap under which he pays two times the floating rate but on the same notional principal as the original swap. If he wants to be even more speculative he can multiply this leverage or even enter a swap in which he receives a very much off-market fixed rate and pays Libor-squared. Since Libor-squared rises faster the higher Libor is, this is extremely speculative. However, the point is that leverage itself is not as useful a concept in risk management as it might seem. Internal controls should focus on the potential cash flows that might arise from transactions, the mark-to-market value of such instruments and the factors that affect that and the value at risk of the portfolio.

Libor: the commonest **floating-rate** reference index used in interest **rate** derivatives.

/enhancement accrual **note**: A range **floating-rate note** that pays an above market **floating-rate** coupon every day that Libor remains within a predetermined range. This range is frequently stepped so that every three or six months, one or both of the boundaries is refixed. In a positive yield curve usually it is the upper limit that is moved up. Investors in these notes are taking both a directional view on interest rates as well as a volatility view. Those who have to mark-to-market should note that the embedded short binary options position is complex to value and extremely sensitive to volatility, especially when the boundaries are being approached. For example, if Libor has traded through the lower boundary, the note will actually gain in value if Libor or the forward rate then reapproaches the lower boundary, while the same rise just below the upper boundary will have the opposite effect. The note will begin to lose value even before forward Libor crosses this upper limit as the binary option, which the investor is short, has a non-zero delta and 50 increases in value as it reaches the strike. Binary options also have larger vegas than other options, which increases the volatility risk of the notes. In high rate environments in which the yield curve is steep, the notes rapidly approach the value and duration of a zero coupon instrument.

/-in-advance swap: An interest rate swap in which the Libor rate is reset at the beginning of the previous period except for the first period where Libor is set at the beginning of the corresponding period as in a conventional swap. This effectively shifts the floating Libor periods back by one period except for the first. While the Libor-in-arrears swap is conventionally used to give fixed-rate receivers a higher fixed rate in return for Libor-in-arrears in a steep yield curve environment, the Libor-in-advance swap allows the fixed-rate payer to pay a lower fixed rate in exchange for receiving Libor in advance in the same type of interest rate environment.

/(set)-in-arrears swap: One of a class of interest rate swaps whose floating-rate leg is customized through manipulation of the reset dates on which rate fixings are made. In a conventional swap, floating interest payments are reset in advance, at the beginning of each (usually semi-annual) period and paid in arrears. So the six-month Libor rate

payable in six months' time is determined by the Libor rate in effect at contract origination and paid at the end of the six-month period. At the 12-month settlement, the coupon payment is determined by the six-month Libor rate prevailing at month six and so on.

In a Libor-in-arrears swap, interest payments are both set and paid in arrears. That is, the first Libor fixing is after six months, just two days before the payment date, and is determined by the six-month Libor rate in effect at month six (not at contract origination) and subsequent rates are set at the end of each period. So, with a standard swap both parties know the amount of the floating-rate payment six months in advance. With the Libor-in-arrears swap, neither party knows what the payment will be until it is due.

This effectively extends the floating-rate payer's exposure to Libor by one additional interest period and means that the forward rates that are used to determine the fixed-rate payment in the swap are one period further out than on a standard swap. If the yield curve is steeply positive, this means that the fixed-rate for the Libor-in arrears swap will be higher than for the standard swap because the forward rates are higher.

Another way of looking at it is that the market is implying that short-term rates will rise. Therefore the market expects that setting Libor in arrears will result in a higher Libor being set and therefore a higher payment than if Libor is set normally. Therefore the market will pay an incentive to any counterparty that wishes to pay Libor in arrears. So, if the market is expecting Libor to be on average higher at the end of each six-month period by 50 bp, then in a floating-floating Libor-in-arrears swap a counterparty could receive Libor and pay Libor-in-arrears less 50 bp. The swap would be advantageous if Libor falls over the period or rises by less than 50 bp.

This shows how the swap is  priced: the market expects Libor to rise 50bp over each floating period and so is willing to receive Libor-set-in-arrears less 35 bp. The price adjustment is therefore the present value of the average expected increase in Libor over the period, calculated from implied forward Libors for that period.

Libor-in-arrears swaps are a way of taking a view that future spot rates will be lower than those implied y the forward curve, though the buyers view on absolute rates may not be much different from that expressed by a conventional swap. If interest rates do not rise as sharply as the yield curve suggests, the Libor payments will be less than those on a conventional swap can be fixed-for-floating or floating-for-floating. Most commonly they are used by fixed-rate receivers (for example, treasurers swapping fixed-rate bond issues into floating) who benefit from the steepness of the yield curve by paying Libor-in-arrears in exchange for a higher fixed rate. Floating-floating versions are sometimes used by investors who would receive Libor and pay Libor-in-arrears if they believed rates will not rise as fast as the implied forward curve suggests.

There are a number of more recent variants of the structure. In a less aggressive version of the Libor-in-arrears swap, counterparties can choose to receive a fixed-rate and pay floating with the option to pay Libor-in-arrears (and receive a higher fixed rate). The fixed-rates payable will be lower than that in the full Libor-in-arrears swap to take into account the cost of this option. Alternatively, if the counterparty wants to take a more aggressive view on the forward curve than in the standard Libor-in-arrears swap, he can choose to receive an even higher fixed rate than in the Libor-in-arrears swap in exchange for agreeing to pay the greater of six-month Libor and six-month Libor in arrears. This floating rate liability could be capped at a catastrophe level.

Also known as an arrears (rate) reset swap or delayed Libor reset swap. See implied forward, zero premium cap.
/function swap: An interest rate swap to whose floating-rate leg a customized mathematical function or equation has been applied to produce a payout profile tailored to a very specific view of rate movements.

/regulating swap: An interest rate swap under which one par receives Libor and pays a blended rate calculated as the combination of a predetermined fixed rate and a predetermined floating rate. The blended rate is capped at a maximum.

For example, a treasurer that could pay fixed at 6.71% in a three-year semi-annual swap could instead elect to enter a $100million Libor regulating swap in which they receive six-month Libor and pay the minimum of (6.90% + six-month Libor)/2 and 7.75%. So, if the average of the fixed and floating rates stayed below 7.75%, then the treasurer would pay the blended rate. If that average were above 7.75%, his fixed-rate payments would be capped at 7.75%. In this example, the blend of fixed- and floating-rate is set at 50:50. This proportion can be customized according to the hedger's views. The swap is constructed from a swap and cap, each for the requisite proportion of the original notional amount. In this example, the swap can be imagined as two swaps, each on $50 million of notional principal. One is a 6.90% pay fixed receive six-month Libor swap, the other a pay six-month-Libor receive six-month Libor. The second swap clearly cancels itself and so the treasurer has simply fixed $50 million at the off-market rate of 6.90%. However, assuming he actually has a liability of $100 million on which he must pay Libor, that leaves $50 million of the original exposure unhedged. For the actual blended rate not to exceed 7.75%, a cap on that $50 million floating portion is needed at 8.6% -- ((7.75 x 2) - 6.9). The cap premium is the difference between the swap rate (6.71%) and the fixed rate portion of the blended rate (6.90%) so that no upfront premium is required.

In a positive yield curve environment the treasurer's cost of funds will be lower than a regular swap (but higher than Libor). Also, the maximum rate is known in advance, though it will be higher than the current market swap rate. Like many other second generation swaps, this instrument is for treasurers who wish to hedge against rate rises but who feel that the current yield curve and implied forward curve overstate future rate rises. See blended interest rate swap, incremental fixed swap, index amortizing swap, index principal swap, semi-fixed swap, Libor-in-arrears swap.

/squared swap: See leveraged swap.

Limit binary option: An option (usually FX) in which the purchaser specifies two exchange rates, one above and one below the current spot or forward rates, and receives a fixed multiple of the premium paid if both levels trade. This is almost the opposite of the range binary option since both levels must be hit for the buyer to profit while with the range binary if either limit is reached the buyer loses. See boundary binary option, corridor option, digital option, range binary option, range floater.

Limit-dependent option: Options whose payout is determined in part by a mechanism that serves to activate or deactivate the option as a function of the level of the underlying asset. The two classes are barrier/trigger options and digital/binary options.

Limited risk differential swap: A differential swap combined with a cross-currency cap/floor. The combination allows the user to benefit from the interest rate differentials between two currencies while capping/flooring the maximum loss incurred if the differentials move adversely.

Linear forex-linked swap: An interest rate swap one of whose legs is linked to movements in a foreign exchange rate. Changes in the reference foreign exchange spot rate result in linear changes in the coupon rate paid/received under the swap. This swap allows borrowers, for example, to swap their debt into an interest rate that varies directly with a foreign exchange exposure they have. Adverse movements in foreign exchange rates are offset by smaller interest rate payments on their debt.

Linear regression: Simple linear regression is a type of regression analysis involving only two variables whose relationship is assumed to be linear. The term linear means that the value of the dependant variable y is determined by the independent variable x and that the relationship is: y = a + bx + u, where a is a constant; b is the regression coefficient and u is the error or disturbance term. See heteroscedastic.

Lognormal distribution: A variable has a lognormal distribution if the logarithm of the variable is normally distributed. The lognormal distribution is used in option pricing to describe the likelihood that the market will vary from current levels by the end of a given time period. Standard option pricing theory postulates that the spot price of the underlying follows a lognormal random walk -- that is, that a move up by 1% has the same probability as a move down by one degree, and that the mean of the distribution, and therefore the most probable market price at the end of the period, is today's current market rate. In the case of foreign exchange options, for example, that means the forward outright rate associated with the time period. See normal distribution.

Long-term foreign exchange (LTFX): An alternative to currency swaps, these are outright forward purchases/sales of a currency for a future date at a price agreed at the inception of the agreement with no spot exchange at the time of closing. They enable the holder to lock away forward foreign exchange points for periods over 18 months and are used primarily to hedge existing or anticipated exposures such as long-term borrowings or future receivables. LTFX agreements usually entail a single exchange at a future date or a series of exchanges spread evenly over a number of years. They are functionally equivalent to a zero coupon currency swap and can be used to replicate a fixed-to-fixed currency swap. In general though, currency swaps are more flexible.

Lookback option: An option that allows the buyer, at maturity, to choose the most advantageous exercise conditions that have occurred over the life of the option. There are two varieties: the lookback strike option, or floating-strike lookback, instead of having a specified strike price, allows the buyer at expiration to look back over the life of the option and set as the strike the most favourable price that has occurred during that time. A lookback call (put) allows the buyer to choose the lowest (highest) price that has occurred over the life of the option. These strikes are then compared with the spot price at expiration to determine the option's payoff. The second type of lookback option, the fixed-strike lookback, sets a strike at the outset but then at maturity allows the buyer to look back over the life of the option and choose the most favourable exercise point to maximize profit between strike and exercise.

Lookbacks are most profitable to the buyer (net of premium) if the realized volatility of the underlying price is higher than the implied volatility. If a buyer believes that there will be a sharp move in price but is not sure when and for how long the price will move, lookbacks are attractive. Because they allow the buyer to choose the best exercise conditions with perfect hindsight, lookbacks command much higher premiums than conventional options. Also known as hindsight options.

Lookback swap: A swap in which, for example, the holder pays the highest Libor setting in the reset period and receives Libor set at the beginning of the period plus a spread. In a two-year deal with six resets, for example, the holder could receive six-month Libor plus 120 bp and pay the highest daily six-month Libor rate in each six-month period.

Lookforward option: An option that gives the holder the prospective right to the difference between the spot (strike) price at the beginning of a period and its high (call) or low (put) over that period.

M

Mandarin collar: A collar (cylinder, range forward, fence) that is restructured using an overlay of digital options. The underlying collar remains in place but the holder sells a range binary option (a package of digital options) so that as long as the underlying trades within the boundaries of the collar, as the holder of the collar clearly expects it to, then the range binary option produces an additional payout.

Margin: See futures contract.

Margin for credit swap: A credit derivative used to hedge the value of a loan asset which the holder wishes to hold for the medium-term. Instead of paying for a vanilla put option, which would incur upfront premium, the asset holder pays the margin from the loan to the swap counterparty over the life of the loan in exchange for a put at a pre-agreed strike level, say 60 cents on the dollar. At maturity, if the loan has fallen to below 60 cents on the dollar, the swap seller reimburses the holder the difference between that value and the strike of the option.

Other varieties involve the exchange of Libor-related payments streams for payment streams dependent on the ratio of interest rate moves to loan value of a particular asset or portfolio.

Mark-to-market: The process of determining the present market value of a security or derivative position. It is clearly crucial for investors to be able quickly to determine the market value of their positions, but it is also vital that corporate treasurers have this information even for positions put on as hedges. Firstly, it enables them to compare the performance of the hedge versus the underlying liability or asset, to quantify any basis risk and, if necessary rebalance the hedge. Second, by understanding the factors that affect the value of a derivative, the treasurer will be better able to determine the appropriateness of a hedge. One whose value moves in extremes is likely to be highly leveraged and may be difficult to unwind. It should be noted that the mark-to-market behaviour of the price of a derivative its breakeven behaviour as a hedge will differ. For example, a complex swap may breakeven on maturity having incurred mark-to-market losses before maturity.

Mark-to-market cap: An interest rate hedge structure that puts an upper limit on the marked-to-market loss of a swap portfolio. It gives the client to enter into a portfolio of offsetting swaps at any reset period over a chosen period, at strikes that ensure that the mark-to-market loss will not exceed a predetermined amount. For example, a corporate treasurer may have a series of interest rate swaps on his books, hedging a variety of underlying **debt obligations**. This treasurer was previously not required to mark his swaps to market, but recent accounting changes force him to. In this case, he wants to limit any adverse bottom line effects.

Suppose he has a portfolio of five receive-fixed swaps maturing at different dates between October 1996 and October 1998 which currently show

a mark-to-market loss of $4 million. A mark-to-market cap would provide the company with an option to enter into pay-fixed swaps at any rate reset date over the next 12 months exactly offsetting the existing swaps in the portfolio and locking in loss of $4.5 million. Alternatively the options could be cash-settled. The cap premium can be paid upfront or on a periodic basis. The premium itself depends on the underlying parameters of the swap portfolio: tenors, notional amounts, strikes, correlations and embedded option features. Protection on a portfolio basis is cheaper than buying caps on the individual swaps. See interest rate basket options, foreign exchange basket options.

Markov process: A class of stochastic processes. Most option pricing models assume that movements in the price of the underlying or, in the case of interest rate options, the zero-coupon curve, is determined by a Markov process.

Mean reversion: The tendency of variables, most relevantly stock prices, interest rates, and volatility, to trend away from extremely high or low values and to revert to a long-term average level. When the value of a mean-reverting variable reaches a very high level, it is more likely to go down than to go up. Conversely, when it reaches a very low level, it is more likely to go up than to go down.

Mean reversion is important in option pricing because it contradicts an assumption of many early models that the variance of the price of the underlying asset of an option is directly proportional to the option's term to expiration. This assumption implies that the statistical dispersion of asset prices will widen indefinitely further and further into the future. In interest-rate option pricing models it means that interest rates can become negative. (Interest rate model are further constrained in absolute terms: in a normal economy 100% rates are extremely unlikely.)
The practical consequence for pricing is that the longer-dated an option, the more seriously it will be mispriced by models that ignore mean reversion. To account properly for mean reversion and hence estimate the volatility of an economic variable that demonstrates it, a more complicated underlying model than geometric Brownian motion is needed. Models such as Vasicek and Cox-Ingersoll-Roll incorporate mean reversion to account for the term structure of volatility. The Hull-White model goes further by proposing that mean reversion is time-dependent.

Mini premium option: Also called the step payment option, this is an FX option for which no initial premium is paid. If, subsequently, the spot rate moves beyond pre-set trigger points set out-of-the-money relative to the strike, certain fixed premiums are payable by the holder of the option at maturity. For catastrophe insurance, the structure offers potentially zero premium protection. However, if all the trigger levels are reached, then the holder pays more in premium than the equivalent vanilla option. For this to have happened though, the underlying must have moved in the hedger's favour.

An example might be an FX hedger short dollars and long the Deutschmark booked at 1.5700. A three-month mini-premium option (with the forward at 1.5673 and volatility at 9.8%) would have no initial premium but the following terms: premium trigger levels of 1.5300, 1.5100 and 1.4900 with the premium at each level 1.50% US$ (235.5 DM pips). If any of the trigger levels are reached, then the premium is due. If all the levels are reached, a total of 706.5 DM pips will have been paid -- far more than the 1.83% US$ (287 DM pips) payable for the equivalent vanilla European option. See contingent premium option, deferred premium option, pay-as-you-go option, installment option.

Mismatched collar: A collar in which the tenor of the cap and the tenor of

the floor are not equal.

Mismatched payment swap: A swap in which payment streams are not exchanged on the same date. For example, the floating amounts are payable semi-annually but the fixed amounts are payable quarterly. These types of swap are uncommon as they entail greater credit risk than swaps with matched payments.

Modified duration: See duration.

Momentum cap: See adjustable strike cap.

Monetization: The realization of the value of the options embedded in puttable and callable bonds using either government bonds, forward swaps or, most commonly, swaptions. See call monetization.

Money-back option: An option that is guaranteed to pay back at least the upfront premium on expiry.

Money market swap: See basis swap.

Money spread: See horizontal spread.

Monte-Carlo simulation: A generic technique involving the generation of random numbers to solve deterministic problems. It is often used by numerical option pricing models as an alternative to the binomial process as a simulation of the underlying asset price. Using computers, a Monte-Carlo simulation attempts to simulate the process that generates future movements in the price of the underlying. Each simulation results in a terminal asset value and several thousand computer simulations give a distribution of terminal asset values from which the expected asset value at option expiration can be extracted. This method is used to value complex options, particularly path-dependent options for which there is no analytical solution.

Mortgage prepayment cap: A cap on mortgage prepayment rates (usually PSA rates). It protects the holder against the effects of increased prepayment on a mortgage-backed portfolio.

Mortgage (replication) swap: A type of index amortizing swap in which the payment and prepayment rates on a portfolio of fixed-rate mortgages are exchanged for a fixed-rate payment stream. The mortgage-related flows are generated by a pool of mortgages or an index on such a pool. Although the interest payments into this payment stream are fixed, the notional principal can amortize as borrowers prepay mortgages if interest rates fall significantly. If this happens, the notional principal on which the mortgage swap cashflows are calculated amortizes accordingly. This kind of swap allows investors to enjoy the flows from a portfolio of mortgages without taking mortgage assets onto their balance sheets.

Moving strike option: A path-dependent option whose strike depends on the previous path of the underlying. For example a moving strike cap is an interest rate cap whose strike for the next period is based on the current rate level plus a spread. Also known as adjustable strike options, momentum options. See adjustable strike option.

Multi-factor model: An option pricing model in which there are two or more uncertain parameters in the option price. In general, multifactor models are better able to cope with valuations of interest rate options and complex options like spread options, which themselves have several parameters whose volatilities need to be modelled independently and whose correlation is best treated as a separate variable.

Multi-factor option: See rainbow option.
Multi-rate reset: A swap in which the reset and payment periods are unusually frequent. For example, an interest rate swap in which the floating-rate payer pays six-month Libor on a monthly basis.

Multi step-up callable bonds: FRNs whose initial coupon is well above prevailing vanilla **rates** and whose coupon steps up over their lives. The bonds are callable every six months and so investors have effectively sold the issuer a Bermudan call option on the **note** for which they receive the higher coupon. The bonds are usually swapped into **floating rate** Libor in which case the counterparty (paying the multi step-up coupon in exchange for Libor less a spread) holds a Bermudan receiver swaption (to receive the multi step-up coupon) which cancels the swap on exercise. The call on the **note** is triggered by the swap counterparty calling the swap.

Municipal swap: An interest **rate** swap in which the **floating** payments are indexed to the returns from tax-exempt US municipal bonds. The index is generally the JJ Kenny municipal index.

N

N-cap: A modification of the knock-out cap. In a knock-out cap, once the knock-out level has been reached, the protection of the cap either disappears completely or for that period. With an N-cap, once the trigger is reached, the original cap level is replaced with a second cap level for that period. it is therefore more risk averse than the knock-out cap.

For example, a borrower with a three-year floating-rate loan may believe that interest rates will remain at present levels and may begin to fall. However, they want some protection. They could purchase an 8% cap for 250 bp. Alternatively, they can enter an N-cap as follows: a three-year 8% cap, with a trigger at 10% and a second cap level at 11%. The cost of the N-cap is only 150 bp If Libor in the first period is 8.50%, the hedger can claim 50 bp under the 8.00% cap for that period. In the second period Libor unexpectedly rises to 12%. The trigger of 10% has been breached and so the active cap level is now 1%. The hedger claims 100 bp for this period. The cap level for each period is either 8% or 11% depending on the level of Libor. The N-cap is a knock-out cap struck at the trigger level combined with a knock-in cap struck at the second cap level. It will therefore be cheaper than a straight cap but more expensive than a knock-out cap. Also known as a dual- or double-strike cap. See barrier options, hybrid derivatives.

Naked: A long or short derivatives position initiated without any corresponding position existing in the underlying. So, naked position would include being long puts without an underlying position to hedge or being long a swap with no underlying liability or a smaller liability portfolio than the notional principal of the swap. See covered.
Nearly-perfect swap: An interest rate swap in which a fixed rate is swapped into a low, off-market floating rate linked to a reference index such as Libor but subject to the following type of formula: for every basis point that Libor exceeds a pre-set cushion level between two reset dates, the spread over Libor increases by a pre-set amount, say, one basis point. Libor is set at the end of each payment period. The floating-rate payer is taking the view that the velocity of the increase in short rates will not exceed the cushion level.

Net present value (NPV): The difference between the present values of two different cashflows or between the present value obtained at one rate of discount and that obtained at another. So, because there is no upfront

premium payable on an interest rate swap, the NPV of the future fixed- and floating-rate payment streams must be zero. That is, the difference at initiation between the present value of all the future fixed-rate payments due under the swap and the present value of all future floating rate payments is zero.

Neutral hedge ratio: See delta.

Non-stationarity: In option pricing this term often refers to the variability of volatility, a phenomenon usually explained by changes in economic factors. Given non-stationarity, the volatility input into option pricing models should be that which is forecast over the life of the option, not a historical figure.

Non-uniformity: In option pricing used to refer to the fact that volatility is expected to be higher on certain days than on others.

Normal density: The integral under the normal distribution function between two points or between one point and infinity.

Normal distribution: The most widely occurring frequency distribution. The normal distribution is distinguished by its symmetrical bell shape and has the statistically desirable characteristics of being completely described by the mean and standard deviation of the distribution. The mean indicates the position of the centre of the bell, the standard deviation how spread out it is. If a variable is normally distributed, 68.27% of its values will fall within plus or minus one standard deviation of the mean; 95.45% will fall within plus or minus two standard deviations and 99.73% will fall within plus or minus three standard deviations from the mean. However, the normal distribution has several weaknesses for financial models. See lognormal distribution.

Notional principal (amount): The nominal value used to calculate the cashflows on swaps and other cash-settled derivatives. In an interest rate swap, for example, each period's interest rates are multiplied by the notional principal amount to determine the actual amount each counterparty must pay. In interest rate swaps the notional amounts are not exchanged, so any credit risk is limited to the net amount payable plus a potential future exposure factor. Descriptions of the size of the derivatives market almost always refer to notional principal amounts when in fact the amount of money at risk is a tiny fraction of that.

Novation: The replacement of one or more derivative contracts with new ones, often also with one of the counterparties replaced by a new one. One common use of novation is in the creation of chains of swaps which, having been cancelled and reassigned, can be used to provide loans in circumstances where straightforward lending would be expensive or not permitted.

NPV swap: See concertina swap.

Numerical model: An option pricing model which avoids the requirement to solve a stochastic differential equation by specifying a particular process for the underlying asset price and then using an iterative approach to solve the value of the option. The commonest process chosen for the underlying asset price is a binomial process hence these models are also called binomial or lattice models. The most famous is the Cox-Ross-Rubenstein model of 1979. Numerical models can be divided into three main classes: the binomial models, the finite difference models, and Monte Carlo simulations.
O

Off-market: Below or above the market rate.

Omega: (Character omitted) The currency risk incurred by the buyer or seller of a currency option in translating the value of the option to another currency. Also sometimes used to refer to the third derivative of the option price with respect to the price of the underlying.

One-touch: Used of path-dependent derivatives which payout or do not contingent upon a pre-set barrier having been breached at any time during their maturity. In this they differ from at-maturity binary structures that payout or do not contingent upon the underlying level versus the barrier level at expiration.

/option: A type of digital or binary option that pays out if the underlying reaches the strike at any time from start to maturity. They can be considered the equivalent of an American-style digital option versus the European-style digital which only pays out if the underlying has reached the strike at maturity. One-touch digitals are generally priced with the payout fixed at 100. The premium is then adjusted, allowing simple analysis in terms of the payout ratio. For example, if the digital costs 55 cents and the payout is $1.00, then the digital has a payout if 1.818:1.
/swap: A swap in which, for example, a holder pays six-month Libor an receives six-month Libor plus 100 bp for each period in which a pre-set barrier is not breached.

One-way (collared floater): See ratchet floater.

Optimal rate lookback option: See lookback option.

Optimal strike lookback option: See lookback option.

Option: A contract giving the holder the right but not the obligation to buy (call) sell (put) a specified underlying asset at a pre-agreed price at either a fixed point in the future (European-style) or at a number of specified times in the future (Bermudan-style) or at a time chosen by the holder up to maturity (American-style). Options are available in exchange-traded and over-the-counter form and can also be packaged as securities either separately (warrants) or embedded in bonds (embeddos).

Out-of-the-money: An option that has no intrinsic value because the price of the underlying is below the strike price of a call or above the strike price of a put.

Out-option: A barrier option which is a conventional option unless the price of the underlying moves reaches a pre-set trigger price, in which case it is extinguished and ceases to exist. A down-and-out option is extinguished by a downward movement of the underlying through the outstrike, an up-and-out by an upward movement. Also known as a knock-out. See barrier option.

Outperformance options: See rainbow option.

Outstrike: The barrier price of an out-option.

Over-the-counter: The market for securities or derivatives created outside organized exchanges by dealers trading directly with one another or their counterparties by telephone, screen or telex.

Over-the-top-option: An up-and-out option -- a barrier option extinguished if the price of the underlying rises above the outstrike.

P

Parallel shift: A parallel shift in the yield curve, assumed by many hedging strategies, is a movement of each point on the yield curve by the same amount at the same time.

Par swap yield curve: The term structure of swap rates, that is, a yield curve that plots swap rates against maturity and that is derived from the zero-coupon yield curve.

Par yield curve: The curve formed by the yields to maturity associated with bonds currently selling at par. The par curve is important as the yields on bonds selling at par are likely to be more representative of the underlying term discounting rates implicit in the market. Bonds selling at a substantial discount or premium to par are often subject to special forces which distort their prices. For example, a high-coupon bond may be considered an especially desirable investment in an environment where interest rates have bottomed out. Gaps in the curve caused by a lack of available bonds are filled by interpolating from existing bonds the coupons necessary for bonds at those maturities to be priced at par.

Parity: Used in several different senses in the warrant and option markets. Of options generally, parity is the condition in which an option's value in the market is the same as its intrinsic value. In the warrant market though parity can be positive (the warrant has intrinsic value) or negative (it has no intrinsic value).

Part contingent premium option: A knock-in option that knocks-in only if the underlying moves sufficiently against the holder's underlying position. The initial premium is less than for a standard knock-in, but an additional premium is required if the option is knocked-in. See contingent premium option, deferred premium option, mini premium option.
Partial fill plus option: Commonest in the commodity derivatives markets, a partial fill plus option strategy is a swap agreement in which one counterparty receives an off-market high fixed rate in exchange for the market floating rate. In exchange for the off-market rate, the fixed-rate receiver grants the floating-rate receiver the option to double the amount of the swap if the price of the underlying exceeds the swap rate.

So, for example, a company with a total hedge requirement of 100,000 barrels of crude oil per day could enter into a swap under which it was paid $1 more than the going swap rate for its oil on 50,000 barrels. If oil prices rose substantially, then the floating rate receiver would exercise the option and would not only receive a floating-rate higher than the fixed rate it was paying but would receive it on twice the original notional principal of the swap. The swap can also be structured to be of use to the floating receiver.

Partial lookback option: An option whose strike price can be reset to the most favourable level of a pre-set past period (usually between one and three months) after which it becomes a standard European- or American-style option. A lookback period limited to the first part of the option's life will help improve the timing of any market entry; one limited to the last part of the option's life will help with market exit timing.

Participating: In general a derivative holder participates in, that is benefits from, the upside of the instrument.

/cap: A partial cap that reduces exposure to an upward move in the price of the underlying rather than eliminating it completely.

There are two versions. Either the hedger simply buys a cap with a smaller notional principal than the underlying exposure, giving both counterparties

participation on an average basis. Or, if a zero premium structure is required, the hedger simultaneously buys an out-of-the-money cap and sells an in-the-money floor with a lower notional amount. Since the floor is in the money, it needs to be struck on less notional principal to create a zero premium. The structure limits participation in downward rates to the portion of the underlying exposure not covered by the floor sale.

/forward: An FX option position (usually structured so as to be zero premium) in which the put (call) options sold are in-the-money to finance the purchase of call (put) options. This means that fewer options must be sold than are purchased. The position is so called because the hedge rate is commonly the same as the standard forward rate but protection is only paid for if the final asset price is below the strike. As the final asset price declines, the cost of the protection increases. The provider of the floor is paid with a portion of the potential profits -- the seller of the structure participates in upside gains.
The position, sometimes known as a profit-sharing forward can be seen as an adaptation of the range forward in which only a floor is fixed. In place of a premium, the holder agrees to pass a percentage of any gain to the seller. This seller's participation rate varies in proportion to the level of the floor. A low participation rate gives a low floor and vice versa. The buyer has a choice of participation rate and floor. Based on the choice made, the seller then fixes the other variable.

Participating forward positions usually include a position in the underlying: so to hedge against price falls in the underlying, the hedger shorts the underlying or future or synthetic, sells in-the-money calls and buys more out-of-the money puts.

/interest rate agreement (PIRA): A premium-reducing option strategy in which the holder buys cap on a notional x and sells a floor at the same strike but on a notional principal of a proportion of x such that the transaction incurs no upfront premium.

/option: An option which changes the rate of participation in a price or rate movement once the strike price has been reached. For example, a call option on the FTSE-100 stock index might give 100% participation from a strike at-the-money up to the point at which the index has moved up 10%; Then further participation is limited to 50%. Effectively the option holder has sold a call at that level on half the notional principal of the original call. Because of this, the participating option is cheaper than the standard variety.

/swap: Any swap in which one of the counterparties participates in favourable movements in the underlying price or rate while fixing a maximum cost. One interest rate version is an interest rate swap in which the floating-rate payer caps his maximum payment but, by combining the swap with a participating interest rate agreement, retains some participation in any falls in interest rates.

The commodity version works in much the same way: an oil consumer might elect to enter a participating swap under which he agrees to an off-market fixed rate $1 above the swap rate on a conventional fixed-for-floating commodity swap in exchange for 50% participation in any downward movement in price. If the average of the index price over the reference period is above the agreed fixed rate, then the consumer pays that rate and receives the difference between it and the index rate -- capping its cost at the off-market swap rate. If the index price of the commodity is less than the off-market swap rate, then, instead of paying 100% of the difference to the counterparty and receiving the index price as would be the case in a normal fixed-for-floating swap, the consumer pays only 50% of the difference between the two, benefiting from 50% of the price decline below the cap

rate.
Path-dependent option: An option whose payoff is a function of the continuous path the underlying rate or price has taken over the life of the option. This contrasts with straightforward options whose payoff is usually a function of the price of the underlying at only one point: exercise or expiry.

Path-dependent options include average rate/price options, average strike options, lookback options, cumulative options, cliquet options, ladder options, hi-lo options, shout options and periodic reset options. Path dependent options cannot be priced via analytical solutions and to arrive at a price for the discounted expected value of their terminal payoff over all possible paths, computationally intensive numerical methods are needed.

Payer('s) swaption: An option that gives the buyer the right but not the obligation to enter into an interest rate swap paying fixed and receiving floating. It is also called a put swaption as it is analogous to a put on a fixed-rate instrument (that is, an option to issue a bond). The buyer benefits if rates rise as the option will become more valuable. If rates rise above the fixed rate payable under the swaption, then the holder can exercise it and swap an existing floating rate liability into an advantageous fixed rate.

The payer swaption is similar to a cap in that it provides an interest rate ceiling, but it has to be exercised to provide the fixed rate, and once exercised, the holder is locked into paying a fixed rate, unlike the cap holder who can still benefit if rates fall. Also, while caps tend to reference the short end of the yield curve, the payer swaption tends to reference the two- to 10-year part of the curve.

Pay-as-you-go option: See instalment option.

Periodic (reset) cap: A cap designed to reduce premiums through resets of the cap or strike rate. Each reset is effected at a pre-agreed spread above the reference index for each successive caplet period. As a result, the buyer of a periodic reset cap/floor does not obtain the absolute protection against rate increases/decreases that the buyer of a conventional cap/floor does. Also known as a variable strike cap. See ratchet option.

Phi (Character omitted): The same as Rho.

Periodic reset swap: An interest rate swap whose floating payments are reset according to a pre-agreed schedule or index. Usually, the floating-rate payment is based on the average rate of the reference index over the previous period rather than its level on the reset date.

Polynomial swap: An interest rate swap in which polynomial equations (eg, Ax sup 2 +bx+C) are applied to the Libor leg creating payment profiles that can be tailored to outperform vanilla swaps within precisely defined interest rate boundaries. The positions created give the precision of exotic options without the associated dynamic hedging.

Portfolio insurance: See dynamic hedging.

Portfolio option: An extension of the concept of basket options, this is an option on an entire portfolio of stocks or bonds, tailored on an individual basis

Portfolio swap: A tailored basket swap in which the returns from a portfolio of bonds or stocks are exchanged for a reference index. In credit derivatives, a portfolio swap takes the form of a modified asset swap. The swap buyer purchases an asset swap on the paper of a particular issuer or

issuers with the proviso that, if one of a preagreed set of similar institutions with the same credit rating is downgraded, then its paper is substituted for the original bond(s) underlying the asset swap. So the buyer of the asset swap plus portfolio option receives a higher floating rate in exchange for taking an element of credit risk.

Power: Applied to any structure that incorporates leverage that is unusual either on account of its magnitude or on account on its nonlinearity. So called because of the existence of swaps, notes and options that used an index to the power of two, three and so on as one of their key variables.
/Libor swap: Any leveraged swap that pays a multiple of Libor -- usually in exchange for a greatly increased fixed rate if interest rates move against the end user. Power Libor swaps often contain complex embedded options. The most notorious example is the five-year/30-year swap entered into by Procter & Gamble whose formula -- CP plus the following spread

Spread = 98.5 X (5 - year CMT/5.78%) - 30-year Treasury price/100

-- means that for every 1% increase in CMT yields above 5.78%, P&G's payment increases by more than 17% of notional principal per year and every 1% decline in long bond prices costs P&G 1% of notional principal.

/note: A bond or note that pays a coupon that is linked to a power of the underlying index. For example, a coupon might be equal to 25.00% minus (3-month Libor) sup 2  with a floor at zero. Investors in these notes want extremely high returns over a short period of time and in return accept extremely large duration and negative convexity. The equivalent investor position is long a fixed-rate note, short a highly leveraged (and changing) amount of FRN, long a highly leveraged (and changing) amount of out-of-the-money interest rate caps. The formula given above, even if if applied to a two-year note, would have a duration of 14, higher than that of the long bond and since Libor squared increases at a higher rate for higher levels of Libor, the note's duration surges as Libor rises.
/option: An option whose payout is the square (or some other power) of a vanilla option. They are used for hedging changes in options' implied volatility and preserve volatility exposure better than plain vanilla options if the underlying moves significantly in one direction. A plain vanilla option is affected by volatility smile and skew. A power option can be thought of as a book of options of differing strike prices stacked on top of each other, where the number of options for each strike price increases the further out of the money the strike. A two-times power option has constant gamma.

/straddle: The combination of a power call option and a power put option struck at the money.

Preference option: See chooser option.

Premium: In derivatives, the amount paid by an option buyer for the option. An option's premium, technically, equals the probability-weighted sum of all its possible payoff at expiry, discounted to the present. Option pricing models use formulae to calculate this premium, or expected value.

Vanilla options are paid for upfront. Many exotic options are paid for in instalments or have premiums whose payment or the timing of whose payment is contingent upon some event. In the UK warrant market, premium is the negative intrinsic value of a warrant if exercised immediately. See Black-Scholes model, delta, distribution, expected value, lognormal distribution, rho, theta, time decay, time value, vega, volatility.

Prepaid forward sale: The sale of the underlying for the future with the present value of the forward sale paid to the seller at the offset of the

transaction. This is common as a loan substitute in the commodities markets. Oil producers sell oil on a prepaid basis to a lender/counterparty who pays the producer and then hedges his forward oil price risk through the sole of physical crude or using a commodity swap. Producers use such transactions because it enables them to pay off debt today with tomorrow's revenue.

Prepaid swap: See reverse zero-coupon swap.

Prime-Libor differential **notes**: A **floating-rate note** that pays a coupon based on the spread between the Prime **rate** and three-month Libor. While this differential remains high, the yield on these **notes** is higher than on comparable vanilla FRNs. Similar to CMT-Libor differential notes in that they were developed at a time when **rates** were falling and even CMT and Prime FRNs did not offer much yield pickup over vanilla FRNs. The investor is effectively long a Prime FRN and long Eurodollar futures. The notes incorporate a floor to prevent coupons becoming negative. The main risk investors in these notes face is that the relationship between Prime and Libor is not clear.

Principal guaranteed bond/note: A fixed-income instrument that offers investors the guaranteed return of all or a high percentage of their principal plus some, all or a multiple of the rise in value of a particular underlying asset, usually a stock index.

They are most easily constructed by the purchase of a zero coupon bond whose maturity and nominal value matches that of the capital guaranteed instrument. The difference between the price of the zero and its nominal amount is used to buy call options on the desired underlying. The amount of participation in the underlying asset depends on the cash available to buy calls. Falling interest rates reduce the price of the calls but push up the cost of the zero coupon bond. This affects the level of gearing that can be offered. There are various names for this structure, for example Guaranteed Return on Investment Units (GROIs).

Probability distribution: The distribution of probabilities for values of an underlying asset price or other variable. Such a distribution is central to options pricing. It is usually modelled either using numerical models, or by modelling it as a stochastic process using analytical models such as Black-Scholes.

Put option: The right but not the obligation to sell a pre-agreed amount of a specified underlying at a pre-determined price or rate.

Put-call parity: The proposition that the value of a put option is equal to the value of a European call option with the same exercise price and time to expiration plus a riskless investment of the discounted value of the exercise price of the call and a short position in the underlying. For European options, an arbitrage opportunity will exist if this condition is not fulfiled. Put another way, a put purchased alongside a long forward position will synthesize a call and a call purchased alongside a short forward will synthesize a put. Arbitrage prevents the synthetic version of a contract from costing more or less than the original. See conversion, reversal.

Put spread: An options position involving the simultaneous purchase and sale of put options on the same underlying either with different strike prices or maturities or both.

Puttable swaps: A swap contract in which one or other of the counterparties has the option to cancel the transaction. Usually, it is the fixed-rate

payer who has the option to terminate when the underlying falls to a pre-agreed level.

Q

Q-cap: Short for CUmulative cap. An interest rate cap that provides a ceiling on the total interest cost over a period. In exchange for a premium, a borrower receives a guaranteed maximum cash interest cost for the period. The borrower pays the interest charge up to the guarantee level and payments above this are reimbursed by the option seller. The Q-cap is cheaper than a standard cap as long as the period chosen for the cap significantly exceeds the standard three-month reset dates of a standard cap. This is because, instead of the cap seller having to pay out whenever rates exceed the cap, variations in interest rates are added together and may cancel each other out over several periods. This makes the cumulative cap cheaper than a standard cap depending on the shape of the yield curve, the cap's tenor, the periods for guarantee, the strike and interest rate volatility.

The cumulative floor works on the same principle, guaranteeing an investor a minimum amount of interest income from an asset. Also known as cumulative caps, payment caps.

Quanto: A derivative product denominated in a currency other than that of the underlying to which exposure is sought. Quanto is short for quantity adjusting (or is from 'quantun' the size of the hedge from the Latin for 'how much?'), a reference to the variable notional principal of these products which reflects the fact that the face amount of currency coverage they contain rises or falls to cover changes in the foreign currency value of the underlying.

For example, an option on the Nikkei stock index denominated in US dollars will pay the total returns on the Nikkei in US dollars with the exchange rate usually set at the spot exchange rate prevailing at the start of the option contract. To hedge the foreign exchange element of this contract, the option writer must convert the returns from the index from yen into dollars at each payment date. Simple forwards cannot be used because these returns are not known in advance. They must adjust in quantity to match the receipts from the index. The correlation between rises/falls in the Nikkei and strengthening/weakening of the yen against the dollar must be taken into account. If the exchange rate is set at the spot rate prevailing at the start of the option contract, these forwards must also be off-market.

Options with this guaranteed exchange rate feature are said to have been quantized or, after the quanto version of an interest rate swap which is often called a differential swap, diff'd.

/note: See currency protected note.

/swap: See currency protected swap.

/option: See currency protected option.

Quantize: To denominate a derivative and its payment streams in a currency other than that in which the underlying is normally denominated. Also, to diff, for differential swap.

R

Rainbow option: An option whose payout is based on the relationship between multiple assets as opposed to the price or performance of a single asset. Common examples are spread options or better-of-two-asset options. A rainbow option whose payout depends on two assets is said to be a two-colour rainbow, on three assets a three-colour rainbow and so on. Also

known as multi-factor options or outperformance options.

Ramp function: A component of the generalized option function where payoff increase or decrease is defined beyond the break point.

Range binary option: A digital option that pays a fixed multiple of the premium as long as the underlying does not trade outside a pre-set range. If it does, there is no payout and the premium is forfeit. Often combined with a deposit to create interest rate or FX binary range (accrual) notes and in the construction of accrual swaps.

Range forward: The currency markets' version of what in the interest rate markets is called a collar. So called because its payoff matches that of a standard forward, but only within the range set by the bought and sold options which produce a floor and a ceiling. Like a collar the range forward is usually structured so that no premium is payable upfront (while in a break forward the option premium is eliminated by the off-market rate for the forward contract). In the exchange-traded options markets the term is also sometimes used to refer to the more general position of being long a call (put) and short a put (call), sometimes also with a position in the underlying or a synthetic. See break forward, collar, cylinder, participating forward.

Range **floating-rate note**: Short-maturity
FRNs that pay an enhanced coupon over Libor for every day that the Libor daily fixing remains within a predefined interest-**rate** range or
that a specified foreign exchange rate remains within a predefined range. The investor receives no accrued interest for as long as the underlying remains outside this corridor. In general the ceiling is set above the implied forward rate and in later versions of the note the range is reset at the beginning of each coupon period so that investors start each period in the middle of the range or the range structure can be quit (these are known as resettable or resettable quittable range floaters. Another variant allows investors themselves to specify the range and are known as investors' choice floaters.

The basic range floater is essentially a bond or deposit with an embedded corridor option, that is, the investor is effectively long an FRN and short binary options. So, for example, a two-year range floater might pay Libor + 100 bp with interest accruing only on days when three-month Libor is between 3% and 4% in the first six months, 3.125% to 4.75% in the next six months, 3.25% to 5.5% in the third six months and 3.5% to 6% in the last six months. Assuming 360-day convention, so that each semiannual period has 130 days, the investor has sold the following package of binary or digital options: for the first six month period 260 binary options on three-month Libor -- 130 calls with a strike of 4% and 130 puts with a strike of 3%; for the next period, the same quantities of call and puts but with respective strikes of 4.75% and 3.125%, and so on. Every day, one call/put combination is either exercised or expires. If on any day three-month Libor is high enough for the calls to be exercised, then the purchaser of the range note -- the seller of the binary option -- effectively pays the holder of the binary call ((3-month Libor + 100 bp)/360) x principal amount of bond. Likewise, on any day, if three-month Libor is low enough that the binary put is exercised, then the purchaser of the note effectively pays the buyer of the put the same amount. Hence the spread to Libor payable by such notes -- in this case 100 bp -- is determined by the level of premium obtained for the options. This in turn will be determined by the width of the range (the broader it is, the less likely the options are to be exercised and so the less premium they will command) and the volatility of Libor (the higher it is the higher the premium for the options.)
The interest **rate** versions of such **notes** were first
developed for investors who did not want to invest in inverse

**floaters** but who nevertheless wanted a bullish **rate** play. The coupon of the range **floater** can be fixed- or floating-**rate**, though most are floating. The FX versions are commonest at present. For example, a US dollar investor might want to improve upon the current one-year dollar deposit rate of 7.65% by taking a view on dollar/Deutschmark exchange rates. For the right to enhance his yield if his rate view is correct, he is willing to accept a lower minimum yield. So, part of the 7.65% depo rate is used to buy an FX corridor option with a corridor range of 1.4500 to 1.6500 and a pay-out ratio of 1:2.75 (that is, the maximum payout of the option is 2.75 times the premium invested. The option costs 5.00% of the amount invested, so if the spot rate traded outside the range for the entire year, the investor would receive no additional payment and would receive a yield of just 2.65% (7.65% - 5.00%). The return on the note is calculated as yield = 2.65%($) + (no. of days spot fixes in the range x fixed multiple of premium)/total business days in option period. In this case, the minimum payout is 2.65% and the maximum is 16.40%.

The above FX and interest **rate** examples pay interest on days when the spot **rate** trades within the range and nothing on days when it does not. A similar type of range **floater** is the fixed accrual **note** which has two fixed coupons, one (high) payable on every day that the underlying trades within the range, the other (low) payable on every day it does not.

There are also binary versions of the range floater, known also as binary accrual notes. This is a more aggressive version of the standard range floater since any breach of the boundaries cancels the embedded range binary option completely, leaving the investor with just the minimum yield and no further opportunity to accrue interest if the underlying trades back inside the range at a later date. Given this increased risk, the maximum yields are much higher: a range binary option with the same boundaries as the FX corridor option above would cost less (2.00% of the amount invested) and its payout ratio would be much higher (1:12). This gives a minimum 5.65% return and a maximum 29,65%.

There is yet another variant, the limit binary range floater, which pays out its enhanced yield only if both boundaries are hit. All these notes are usually structured with a guaranteed return of principal. They are also known as a fairway bond or an accrual note. See boundary binary option, corridor option, flexi range floater, Libor enhancement accrual note, limit binary option, range binary option, yield curve accrual note.

Range (floater or Libor) swap: See accrual swap.

Range warrant: A warrant that pays out a predetermined amount if the underlying remains within a pre-set range. First seen privately in 1989 and publicly in 1990 long before range-FRNs and other structures including digital options, these were common in Germany. This was because the warrants were tax-driven and the range was irrelevant, the boundaries being set so wide that they would never be reached.

The warrant might have a premium of Dm300 and payoff Dm330 if a stock that normally traded between Dm400 and Dm450 traded between Dm50 and Dm800. This simply approximated the return on a money market instrument but, as a capital gain, was tax-free. When this became too transparent, a second, multi-tranche, structure was created in which one tranche received a payout of the underlying if it traded within a certain range, another tranche received a payout if the underlying traded within a different range and so on.

The idea remained the same. The tranches were calculated so that, if bought

in a certain combination, there would be a guaranteed tax-free payoff that on a post-tax basis made the warrants more attractive than an equivalent money market investment.

Ratchet: Used of a variety of derivatives structures in which key variables such as strike prices are resettable, which in some cases leads to investors' gains are locked in regardless of future movements in the underlying.
/cap: See adjustable strike cap.

/floater: An FRN that pays a high floating coupon, say Libor plus 65.5 bp, subject to a condition that the coupon cannot rise by more than a fixed amount, say 25 bp, from the previous coupon level nor fall below the previous coupon. The note has a high first coupon of, say, 4.655%. The investor is effectively long an FRN, short a path-dependent or periodic cap and long a path-dependent or periodic floor. In other words, this is another structure in which investors are taking a view against the forward curve. In a steep forward curve environment in which it is implied that rates will rise 2% or 3% in the next year, a cap that protects its holder against any rate rise of more than 25 bp in a quarterly period will be expensive (though not as expensive as a vanilla cap) and so the investors in this ratchet floater will be well compensated for selling it. Equally, the floors the investor is buying will be cheap. This combination is behind the rationale for the note: to provide a high coupon floor at a time when although the forward curve is implying sharp rate rises, the investor believes rates may fall or rise much more slowly. The risk for the investor is that the note will severely underperform if rates do rise (particularly for variants of this structure where the coupons are mode more generous by the inclusion of a knock-out feature so that if rate rise above the knock-out level the note only pays a nominal coupon) and the volatility risk due to the complex embedded option position can make the note behave strangely on a mark-to-market basis. Also known as a one-way floater and a sticky floater.

/option: An option which allows holders to capture a high proportion of the appreciation of an index as it goes up (call) down (put) and to freeze these gains at pre-set price levels regardless of the future path of the underlying. See ladder option.

/swap: An interest rate swap in which the fixed payment stream can be reset to a pre-agreed level at predetermined intervals. See periodic (reset) swap.

Rate differential option: See cross-currency option.

Rate differential swap: See currency protected swap.

Rate lock: An agreement that enables the purchaser to lock in the underlying rate but not the spread for an agreed period from a forward date.

Ratio forward: See participating forward.

Ratio spread: A ratio forward (back) spread is the simultaneous purchase (sale) of in- or at-the-money options and sale (purchase) of a larger quantity of out-of-the-money options.
So, a ratio call (forward) spread is the simultaneous purchase of at-or-in-the-money calls and sole of a larger number of out-of-the-money calls. The position will make money from the long calls as long as the underlying rises. If however it rises beyond the strike of the short calls so far that the premium income from their sale is eroded, the losses on the position are unlimited.

A call ratio backspread is the sale of an at-the-money or in-the-money call and the purchase of out-of-the-money calls on a ratio basis. The more calls bought, the higher the maximum profit. The more calls sold, the lower the cost of the overall position. Either calls or puts can be used to create ratio back/forward or call/put spreads.

Real-estate swap: A swap involving the exchange of the returns from a pre-agreed property index, such as the US Russell NCREIF Property Index, a benchmark index which takes into account the yield on 1,800 properties throughout the US, for a financial index such as Libor. Such swaps are used by institutional investors who wish to reallocate assets away from property at times of low yields, but who do not want to take the capitol loss of selling the property in a bear market.

Receiver('s) swaption: A swaption giving the holder the right to receive fixed rate under an interest rate swap. As it is analogous to having a call option on a bond, it is also known as a call swaption. Just as a payer swaption is similar economically to a cap, so a receiver swaption behaves like a floor.

Reflex cap: A reflex cap is a normal cap where the premium is paid periodically, and each installment is dependent upon a trigger rate being reached. The total premium will be low if the reference rate stays below the trigger, but will higher if the rate is above that trigger.

An example might be a company that wants to hedge a three-year floating-rate loan on three-month Deutschmark Libor. Their view is that DM Libor will peak at 9.50%. A standard interest rate cap with a strike of 9% would cost them 4% upfront. Instead they can enter a reflex cap at 9% with a trigger rate of 10%, just above the expected peak. This structure would cost the company 19 bp for every period Libor resets below 10% and 62 bp for every period Libor resets above 10%. Deutschmark Libor would have to stay above 10% for more than none out of the 12 months for the standard cap to outperform the reflex cap on a present value basis. The periodic premium is therefore low when Libor is marginally above the strike and higher when the cap is deep in-the-money. The buyer is paying more for the cap when it is most valuable.

The reflex cap is a combination of a normal interest rate cap and a series of digital options at expire on every reset date. The normal cap is partially paid for by a pre-set amount per period (which would be 19 bp in the example) and partially by the sale of the digitals (43 bp per period in the example.)

The reflex cap provides full cap premium without an immediate premium payment; costs less than a vanilla cap if never used; and is advantageous where the view is that rates will not rise dramatically above the strike, although if it does, the higher premium is only payable in those periods where the cap is deep in-the-money.

Refinery margin swap: See crack spread swap.

Relative performance option: See rainbow option.

Rental option: See installment option.

Replication: To duplicate the pay-out of an option by buying or selling the underlying or futures on it in proportion to its delta. To replicate a call option, the hedger must buy an increasing amount of the underlying if its price is rising and sell increasing amounts if the price is falling because calls are delta positive. The opposite is true of put replication.

Volatility and substantial price gapping makes replication difficult in practice. This kind of dynamic hedging is central to the theory of portfolio insurance. See delta.

Repurchase agreement (Repo): An agreement to buy (sell) a security with a simultaneous agreement to sell (buy) the same **security** at a predetermined future date. This price represents the **interest** rate applicable over the life of the repo and is known as the repo rate. A repo is therefore economically a collateralized loan that, particularly when the securities making up the collateral are in great demand -- known as 'special', can yield more than deposits. The transaction represented by the brackets is known as a reverse repo and has been used by companies wishing to take a view on the spread between long and short rates. They use reverse repos to borrow money which is then invested in long-dated securities. Reset-in-arrears swap: See Libor-in-arrears swap.

Reset option: An option whose strike price may be reset to a lower (call) or higher (put) level during the life of the option if it is out-of-the-money on the reset date. The reset can be predetermined in size and may be triggered between reset dates if the underlying reaches a pre-agreed level. See adjustable strike cap.

Resettable range floater: see flexi range floater.

Retractable swap: See callable swap.

Reversal: One of the arbitrages which maintains (and relies on) put-call parity. If a put is overvalued (or if the put is fairly valued but the call is undervalued), a riskless profit can be made by selling the put, buying a call, and selling the underlying or the future. This position, known as the reversal, is a synthetic long futures position hedged by the sale of the futures contract.

The other arbitrage which maintains put-call parity is the conversion -- a short synthetic futures position hedged by a position in the underling or future. If the call is overvalued (or the call is fairly valued but the put is undervalued), the riskless profit is generated by selling the call, buying the put and buying the underlying or a future.

The actual arbitrage return depends on the additional borrowing costs/investment returns from the money market transactions which fund/result from these trades. Also referred to as reverse conversion. See conversion.

Reverse contingent (premium) option: The put version of a contingent premium option. That is, a contingent premium option whose premium is only due if the option expires at- or out-of-the-money.

Reverse **floating-rate note**: See inverse **floater**.

Reverse indexed principal swap (RIPS): An indexed principal swap in which the notional principal amortizes as **rates** rise. Most often used instead of a vanilla interest **rate** swap to transform a floating-rate asset to a fixed-rate asset. It gets around the problem that an asset so swapped will lose its value if rates rise and returns will be reduced if the investor is short-funded. An interest rate cap incurs an upfront premium and may expire out of the money. The reverse IPS amortizes as rates rise thus reducing the size of the fixed-rate asset. Higher cost funding can then be utilized to invest in higher-yielding assets. In the same way, fixed-rate liabilities swapped into floating will incur increasing interest expense when rates rise. The reverse IPS can be used to hedge against this. See indexed principal swap.

Reverse index amortizing swap: A fixed-for-floating interest rate swap whose floating rate payments are linked to an index such as Libor or CMTs and which increase if the index declines. Receiving fixed in a reverse index amortizing rate swap provides a hedge for instruments that amortize as rates decline, although it is important to ensure that the indexes on which the amortization or accretion schedules are based are highly correlated.

Reverse interest rate collar: The combination of a reverse FRN and an interest rate collar to produce an interest cost or yield that decreases as rates rise and increases as rates fall, but within a pre-set range.
Reverse principal exchange rate linked security: A currency indexed note whose principal repayment varies inversely with the value of a currency versus the repayment currency -- for example, a note repaid in dollars that varies in value according to the yen/dollar rate.

Reverse risk reversal: The simultaneous sale of an out- of-the-money put, the purchase of an out-of-the-money call and the sale of the underlying or a futures contract on it. The resulting payoff is the mirror image of the range forward or risk reversal. The position benefits if the underlying falls

Reverse swap: A swap agreement with the same terms and opposite counterparties to an existing swap such that, if entered into, it will cancel out the obligations of the original swap. Reverse swaps are more complex than simply cancelling an existing agreement and so will only be used if there are specific tax or accounting benefits.

Reverse zero-coupon swap: A swap in which the fixed-rate payer's obligation is fully discharged at the outset of the transaction through a single payment calculated on the basis of the present value, discounted to that payment date, of the stream of fixed payments that would have been payable over the term of a conventional swap. The present value is usually adjusted to take account of the greater credit risk involved in this kind of mismatched structure than in a matched payment structure. This mismatched structure makes the swap functionally equivalent to a loan and entails similar credit risks. Also known as a prepaid swap.

Reversible swap: An interest rate swap in which one of the counterparties has the option to alter their payment basis from fixed- to floating-rate (or vice versa) on or after a pre-agreed date. This is achieved by combining the interest rate swap with a swaption for twice the original principal amount, one half of which cancels out the swap. See flexible swap.

Rho (P): The change in option premium for a one percentage point change in interest rates. The effect of interest rates on options premiums is complex. However, an option's payoff will be realized at expiry while the premium is payable at the offset. If the premium is to be equal to the expected value of the pay-off, it must be adjusted for the time value of money: the future number is discounted so that the present value of the premium is equal to the present value of the pay-off.

In general, the higher interest rates, the higher will be the value of the call option and the lower will be the prices of a put option. This is because the higher interest rates, the lower the present value of the exercise price of an option and so the higher the value of a call and the lower that of a put. Put another way, in buying a call instead of the asset, the buyer releases capital to be invested in a risk-free asset.
Risk-neutral pricing principle: Developed by John Cox and Stephen Ross, the theory that stock options may be valued as if the underlying stock's mean

rate of growth is equal to the riskless rate.

In particular, the value of a European option is the discounted present value of the payoff under the risk-adjusted probability distribution for the stock price at expiry.

Risk reversal: The option traders' name for what the FX hedging markets call a range forward and the interest rate hedger would call a collar or cylinder. As a trade though the position is a little more specific: while the strikes of the calls and puts in a hedger's collar or range forward are usually chosen so as to reduce initial premium to zero, a risk reversal is a combination of a purchased (sold) put and a sold (purchased) call with the same expiry and with the same or very similar deltas (that is, the opposing options are equally out-of-the-money forward. The position is a way of taking advantage of volatility skew: the implied volatilities of out-of-the-money puts and call of the same strike and maturity are different, and the behaviour of this difference can be traded by those with a directional market view.

Roll-Geske-Whaley option-pricing model: A extension to the Black-Scholes model incorporating the independent work of Richard Roll (1977), Robert Geske (1979) and Robert Whaley (1981) and providing a solution for the pricing of American-style call options on assets paying dividends. Behind the model is the observation that an American-option can be viewed as a portfolio of three options: a European option on the underlying; a European option to exercise the first option which will not be exercised until the instant before the ex-dividend date; and a compound option written on the first option (to incorporate the cost incurred, by exercising the first two options of forfeiting the remaining life of the first option).

The model can also be used to value calls on stock indices and American puts on stocks that do not pay dividends but cannot be used to value American puts on assets that pay dividends.

Rollercoaster swap: A generic name applied to swaps whose notional principal is different in different payment periods. Such swaps' notional principal generally increases and decreases periodically to accommodate cashflows that differ predictably on a seasonal basis or to accommodate **debt obligations** scheduled to rise and fall. See also accreting, amortizing, step-up and step-down swaps.

Rolling reset swap: A swap where one counterparty pays the lowers of the arranged swap rate or the prevailing market rate on the roll date for the same tenor.

Roll-lock swap: A swap used to hedge roll risk. This is the risk that long-term hedgers face when using short-term contracts. As each expiration approaches, hedgers sell futures contracts they own and re-enter the position in a more distant month. The cost differences can be expensive and can also create tracking error.

Under a roll-lock swap the roll-lock payer pays the average of the cost of the roll (defined as the difference between the near and next futures contract) measured at pre-agreed times before expiration. The roll-lock receiver pays  a Libor-based rate set at a pre-agreed time after the expiration of the near contract. Also known as a rollover lock.

Roll-up option: An option whose strike price is favourably reset at the same time as the option itself is converted into knock-out option if the price of the underlying asset trades through a predetermined trigger point, usually struck at a point where the underlying has moved significantly against the original option. So, if the underlying stood at 80, a roll-up

put with an original strike of 80 might be converted into an up-and-out put with a strike of 100 and an outstrike of 110 if the underlying traded to 100. The holder has a new, more favourable put strike, but if the underlying continues to rise (ie in his favour as long as his put is hedging an existing position) then the put is knocked-out (at a point where he does not need protection).

The roll-up put outperforms the standard put if the roll-up trigger is reached but the outstrike is not. If the roll up trigger is not reached, then the roll-up put and vanilla put behave the same. Only if the roll-up trigger and the outstrike are reached does the roll-up underperform the vanilla instrument.

S

Seagull: An options position consisting of a purchased call and two sold puts, one with a strike well above that of the call, the other with a strike below that of the call. This produces a schematic payoff profile that resembles a tilted and elongated 'M' -- like a schematic representation of a bird or seagull. See condor.

Seasonal swap: A rollercoaster swap in which the notional principal amount switches between zero and a variable amount to hedge the seasonal borrowing needs of the user.

Second generation structured assets: Bonds and notes incorporating design complexity in addition to embedded options. These include notes containing index maturity to reset frequency mismatch (such as a CMT FRN with coupons linked to 10-year Treasury rates but that are reset and paid on a quarterly basis), notes that pay a coupon based on the differential or sum of a number of indices, notes that include embedded exotic options, notes incorporating quantization and notes containing very highly leveraged formulae.

Securities indexed swap: The class of swaps whose main example is the equity indexed swap. In such a swap, the fund manager pays a market benchmark return, say Libor or the CP rate, and receives a rate of return based on an equity or other market index.

Self-funding cap: The cap version of a contingent premium option. It has no up-front premium. Instead, a predetermined premium is paid only at those resets where the cap is in-the-money. If the cap expires out-of-the-money, the buyer makes no payment. In exchange for the guarantee that its premium will not be wasted, the premium is higher than for a conventional cap. This is useful for those who want interest rate protection but who would rather pay later when the premium is more likely to be required.

The instrument only works when the yield curve is steeply positive as it exploits the higher implied forward Libors to pay for the cap. It does not cap Libor in the same way as a vanilla cap, rather it caps Libor set in arrears. This is because of the way it is created. Under a straightforward Libor-in-arrears swap a borrower receives Libor (set in advance as normal) and pays Libor set in arrears. In a positive yield curve environment this means paying Libor-in-arrears less a discount, to compensate for expected higher future Libors. This annual discount can be converted to an upfront payment and used to purchase a cap on Libor- in-arrears. The upfront payment is used to buy the lowest strike cap affordable. As a rule of thumb, the cost of a three-year cap on six-month Libor-in-arrears will cost almost the same as Also known as zero premium cap.

Self regulating swap: The name applied to a number of different interest rate swaps which offer hedgers a blended fixed/floating interest rate swap

when the cost of fixing has been driven up by a steep implied forward curve. See blended interest rate swap, incremental fixed swap, index amortizing/principal swap, Libor regulating swap, semi-fixed swap.

Semi-fixed swap: An interest rate swap in which there are not one but two fixed rates. Which of the two is payable/receivable depends on whether Libor has reached a predetermined trigger point during each periodic Libor setting. For example, a floating-rate borrower who believes that rates will not rise as quickly as the implied forward curve predicts can receive Libor and pay a below market fixed rate while Libor remains below the trigger point. If Libor exceeds the trigger, then the higher fixed rate is payable. The trigger mechanism is created with an embedded binary option. There are also commodity-linked semi-fixed swaps, particularly in the oil market. For example, an oil consumer might pay a fixed rate of 4% if oil prices stay above $12 but if prices go below that level, he is swapped into 3.5%. That is, he has bought a swap plus a binary option on oil. See blended interest rate swap, incremental fixed swap, index amortizing/principal swap, Libor regulating swap.
Shout option: A path dependent option that allows the purchaser to lock in a minimum payout (the intrinsic value of the option at the time of the 'shout') while retaining the right to benefit from further upside.
So-called because when the option holder thinks the market has reached a high (call) or low (put), he 'shouts' and locks in that level as the minimum. If the market finishes higher (call) lower (put) than the shout level, the holder benefits further. Shout options can be structured with multiple shouts, but they are very expensive.

A corporate treasurer might be bullish on US$/Deutschmark rates but also expects the cross to be very volatile. He is worried that using a vanilla option will mean that he misses out on temporary highs. A shout call solves the problem. If the dollar/Deutschmark rate rises above the strike price, but stays below the shout level, the treasurer receives a profit of the shout level less the strike level. If the exchange rate closes above the shout level, the investor will receive that additional profit as well. The payout is therefore the maximum of (shout -- strike) and (close -- strike).

The shout option is similar to a ladder option in which profits are locked in when the underlying rises/falls sufficiently to hit a redetermined 'rung' level, but in the shout option the rungs are not set in advance. This makes the shout option more expensive than the ladder option, the more so when multiple shout are allowed. The more shouts that are allowed, the more like a lookback the shout option becomes. The ability to lock in gains before expiry makes the shout more expensive than a standard European option, and the fact that even after a shout, the option holder effectively has another option struck at the shout level, makes it more expensive than an American-style option.

Sigma (Character omitted): The standard deviation or volatility of the instrument underlying an option.

Single-factor models: An option pricing model that incorporates only one uncertain parameter, the future price of the underlying. Such models make fixed assumptions about other variables such as the term structure of interest rates, variance and volatility. Multi-factor models which can accept more than one parameter are better able to model interest rates and volatility and are necessary to price options on a number of underlying assets (such as spread assets) correctly.

Spot rate: In currency markets, today's market exchange rate for a transaction now. In interest rate markets, the spot rate is the rate at which a single future payment is discounted back to the present. That is, where observable, the n-year spot rate is the yield to maturity of a zero

coupon bond with a maturity of n-years. For maturities at which zero coupon bonds are not available, the spot rates can be bootstrapped from coupon paying bonds at those maturities since the price of these bonds is the present value of all their cash flows with each cash flow discounted at the appropriate spot rate.

Spot yield curve: The curve that plots spot rates against term to maturity. See par yield curve.

Spread: The difference between the yields on two financial assets (aside form the bid/offer).

/-lock: A structure that enables the holder to lock in a fixed spread between two assets or indices.

/-lock agreement: See roll-lock, rollover lock.

/-lock option: The option to enter into a spread-lock agreement or swap.

/-lock swap: An interest rates swap in which one payment stream is referenced at a fixed-spread to a benchmark index, often US treasuries.

/option: An option struck on the spread between two underlying assets, usually two interest rate indices. The option pays the difference if positive (call) negative (put) between the two indices. Spread caps and floors are also available. For example an at-the-money cap on the spread between US dollar Libor and the CMT rate will profit if the spread widens and lose if it narrows. A spread option on different areas of the same yield curve is called a yield curve option.

/rate differential options: See cross currency option.

/trade: In derivatives either a trade designed to profit from movements in the spread between two or more underlying indices or an options trade involving the simultaneous purchase and sale on the same underlying.

Stack hedge: Rolling short-term derivative contracts to hedge a longer term position.

Staged drawdown swap: See accreting swap.

Step function: A function that defines a fixed payoff beyond a break or barrier point.

Step payment options: See mini premium options.

Step-up (down): Applied to cashflows, option strike prices or swap and option notional principal amounts that rise (fall) according to a preset schedule or formula, to bonds whose coupon payments and to derivatives whose notional principal increases (decreases) according to such a schedule.
/down option: An option with a downward strike price reset subject to a number of conditions concerning the period over which the resets occur and the trigger events for it occurring.

/up bond: A bond that initially pays the investor an above market yield for a short non-call period and then, if not called, steps-up to a higher coupon rate. If the bond is not called, the stepped-up coupon is below prevailing market rates (if not the bond will have been called). The investor initially receives a higher yield as he has implicitly sold a call option.

/up (down) swap: A swap whose notional principal rises/falls to match the known drawdown or amortization of an asset or liability. A company with an amortizing floating-rate loan would be a natural user of a step-down (amortizing) swap, a company with a multiple disbursement loan facility that knew its schedule for drawdowns would use a step-up swap. Sometimes also used of an interest rate swap whose fixed rate steps-down over the life of the swap.

/up cap: A cap whose strike goes up for subsequent periods at predetermined levels. See adjustable strike cap, momentum cap, periodic cap.

/up recovery FRN (Surf): The first of the deleveraged CMT FRNs so-called because it has a coupon floor that steps up over time. The non-stepped version is a **floating-rate note** which pays coupons linked to yields on comparable longer-maturity bonds and incorporating a high coupon floor and some participation if **rates** rise (via a higher coupon).

The **notes** appeal to investors who wish to obtain a higher **floating-rate** yield than can be achieved with either CMT or vanilla FRNs. The risk is that any yield curve flattening will result in a lower yield advantage over vanilla FRNs. The investor is effectively short Treasury bonds and long an in-the-money T-bond call option. They also appeal to investors who can classify them as standard 0.25 duration floaters (because of the quarterly resets) while earning a yield pickup on such instruments. It should be noted that they do not actually have a duration of 0.25; instead the duration characteristics are asymptotic, complex and not intuitive.

For example, a five-year dollar Surf might pay 0.5 x (10-year CMT) + 1.50% subject to a coupon floor of 4.50%. The floor is higher than yields on benchmark Libor FRNs. In low interest rate environments the SURF will outperform CMT FRNs but, due to its 50% deleverage, will underperform as rates rise. Like the CMT FRN the note contains mismatch risk between index maturity and reset frequency. This risk is complex. The embedded floor means that volatility will also affect the value of the **notes**.
Step-lock option: See ladder, ratchet option.

Stepped: When used of bonds denotes a bond with a fixed first coupon which then reverts to predetermined **floating rate** formula.
Differs from a set-up coupon in that only the first coupon acts as a step. Usually this first coupon is extremely attractive in comparison with vanilla FRN rates and is an encouragement to the investor to buy highly structured assets that take strong directional views. For example, leveraged inverse floaters and leveraged floaters often have a fixed first coupon.

Sticky floater: See ratchet floater.

Stochastic: Literally 'guessable'. A technical term from statistics.

/variable: A random variable with zero mean and finite variance.

/process: A process which involves a random variable the successive values of which depend on each other in some way.

/volatility: An assumption that volatility is a stochastic variable is made by some option pricing models. It is a more realistic assumption than that of the constant volatility assumed in early single-factor models.
For example, it can help explain the volatility smile effect as it reduces the value of at-the-money options and increases the value of out-of-the-money options. This is because models that incorporate this

assumption allow a greater probability to large movements in the underlying than simpler models.

As stochastic volatility is a non-traded source of risk, using it as an input into pricing models loses their completeness -- that is the ability to hedge options with the underlying asset.

Stoption: See barrier options.

Straddle: A long (short) straddle is the purchase (sale) of a put option and a call option on the same underlying with the same strike price and the same maturity. The position is usually initially delta neutral and so will only have equal numbers of puts and calls when the underlying is trading close to the exercise price. A long straddle position (which can also be constructed from a two long puts and a long position in the underlying or two long calls and a short position in the underlying) will make money if volatility is high; a short straddle position exposes the holder to unlimited downside but will make money if volatility is low.

Strangle: A straddle with two exercise prices used when the underlying asset lies in the range of the two exercise prices and has been showing low volatility. A long (short) strangle would comprise the purchase (sale) of a put option and a call option on the same underlying with the same expiry date but with strike prices set equally out of the money (a position sometimes called a combination) or, in some cases, split. Straddles and strangles involve combinations of two options, which differentiates them from, say, butterflies, which involve combinations of four options.

Strike price/rate: The pre-determined level at which an option can be exercised.

Structured asset: Any bond, note or deposit whose cashflows have been altered by the attachment of a derivative instrument. Structured asset pricing is simple in context -- the derivative is priced as normal and the bond cashflows are altered as required -- but can be complex in practice. The duration, mark-to-market value and other characteristics of structured assets are not always intuitive and should be explored carefully.

Subsidized swap: A swap that pays a fixed-rate below the market rate. However, if rates rise above a certain trigger level, the fixed-rate payer will pay a floating rate set below the then prevailing rate. The result is a below market fixed swap that reverse to a below market floating rate swap when the trigger is hit. The subsidized swap is the combination of a pay-fixed swap and the sale of a cap. The cap premium is used to reduce the fixed rate paid under the swap
So, for example, the sale of a five-year sterling cap at 10.60% will earn the seller 50 bp semi-annually. This amount improves the five-year swap rate from 8.83% to 8.33%. If sterling Libor exceeds 10.60%, the client will be put back into floating at a subsidized rate of Libor less 2.27%. The instrument is ideal for borrowers who want to lock in their floating rate, but do not want to pay the market rate as they believe the implied forward curve significantly overstates future **rate** rise. It generates an attractive fixed **rate** as long as their **rate** ceiling
is not breached. And even it it is, they still do better than competitors paying vanilla **floating rates**.

Superfloater: A **floating-rate note** whose
coupon increases faster than interest **rates** rise. Most commonly
the coupon **floats** at two times an underlying index, usually
Libor, minus a fixed spread. The structure appeals to investors who wish to obtain a high yield in a bearish environment in return for a lower current yield. A typical superfloater might provide an initial running yield up to

200 bp less than a van vanilla FRN, but as rates rise it will produce higher yields as well as capital gains. The investor has effectively borrowed fixed to purchase a leveraged -- in this example two times -- amount of FRN. Put another way, a portfolio that consists of a two-times leveraged superfloater combined with a fixed-rate note of the same notional amount and maturity is equivalent to a regular FRN of twice the notional amount. This should alert investors to the fact that superfloaters exhibit negative duration.

These structures almost always incorporate a floor -- owned by the investor -- that ensures coupons do not become negative. Superfloater characteristics are useful to corporations when structured as superfloater liabilities -- the combination of a floating rate liability (that is, borrowing floating) and receiving floating in an interest rate swap of the same notional principal. This structure creates a net coupon of two times Libor less the fixed swap coupon. It might be used by a corporate with an existing liability whose profits fall when interest rates fall, but whose profit losses are greater than any benefits of lower debt funding costs, perhaps because it has little debt.

/swap: A fixed-for-floating interest rate swap with a reverse risk reversal applied to the floating-rate leg.

Surge options: An option whose strike price is reset on a daily basis to a fixed spread above or below a moving average. This hedges against the risk of rapid price changes rather than absolute price trends over longer periods. Commonest in the commodity markets, a put surge option on the price of crude oil could work like this: whenever the spot oil price falls below the 45-day moving average less two cents, the option is in-the-money. The settlement amount is determined by the difference between the spot price and the strike price multiplied by the number of barrels to be priced each day. A call would move into the money if the spot price moves above the moving average plus a fixed spread.

Swap: See under specific entries.

Swap curve: See par swap yield curve, zero coupon swap curve.

Swap differential (difference) agreement (SDA): An interest rate basis swap agreement to exchange or lock in the differential between a bond or note yield and the swap rate of the same maturity. An SDA contract moves with reference to the difference between the same point on two different yield curves. The SDA allows an investor to profit from the widening or narrowing between two yield curves. The SDA is customized with defined settlement dates, a defined value per basis point move, and one defined point on two yield curves. All payments are made in one currency so there is no currency exposure.

For example, an investor might believe that the differential between the two-year Lira swap rate and the two-year Swiss franc swap rate will narrow over the next year. The investor can enter into a narrowing Lira-Swiss franc SDA for one-year settlement. The value per point can be set at any value in either currency, say Swfr 10,000. The SDA price is given in terms of basis points. If at maturity the difference between the two-year swap rates in the two currencies has fallen below the SDA entry level, the investor will receive Swfr 10,000 for every basis point lower. If the difference is higher than the entry level -- that is, if the curves have widened -- the investor will lose this amount. The entry price is calculated by taking the difference between the implied forward rates from the two yield curves. In the example, the one-year forward two-year Lira and Swiss franc rates are calculated and the difference is the SDA price. Investors who buy the SDA expect curves to widen; those who sell expect

curves to narrow.

Swap rate: The yield to maturity of the swap. That is, the price of the swap which, when used both as a fixed-rate payment and an internal rate of return, will equate the present value of the two payment streams. On a vanilla interest rate swap, the bid swap rate is the fixed rate a marketmaker will pay to receive Libor and the offer is the fixed rate a counterparty must pay to receive Libor. The swap rate is determined by the term structure of interest rates, credit and transaction costs. In currency swaps, swap rates are the forward points on a currency rate -- that is, the adjustments to the spot exchange rate that have to be made to compensate for interest rate parity differences between currencies. See interest rate swap.

Swap rate lock: An agreement that locks in a predetermined swap rate level for a forward swap.
Swap spread: The difference (positive) between swap rates and the relevant government bond market. The spread reflects the credit differential between the swap and government markets but in practice is also heavily influenced by supply and demand factors in the swap market. A glut of fixed payers will widen the spread. A glut of swapped new issuance will reduce it. The spread in any individual transaction will also be affected by the relative credit qualities of the counterparties to the transaction: a triple-A bank marketmaker will quote a wider swap spread to a single-B corporate than to a double-A supranational entity.

Swap spread lock: The spread equivalent of the swap rate lock which guarantees a future fixed-rate payer (receiver) a maximum (minimum) spread over a specified benchmark index (usually a government bond rate) in a forward swap.

Swaption: The option to enter into a swap contract. The simplest swaption is an option to pay (payer or put swaption) or receive (receiver or call swaption) fixed **rate** in an interest **rate** swap. This
can be considered on option to buy or sell a fixed-**rate** bond
versus selling or buying a  Libor flat **floating-rate**
**note**. Typically, the option period is for a year or less on swap maturities of between three and ten years. So a typical transaction might be to buy a three-month payer swaption with a strike price of 7.50% for cash settlement on a notional principal of $50 million. If swap rates rise to 8.00%, the option would be exercised and a cash payment made to the swaption buyer. (Most swaptions are cash-settled.) Swaptions are usually European style, although American-style swaptions, allowing the buyer of the option to enter into a swap at any time after the exercise date, typically on a payment date, are available. Swaptions are also available on currency and basis swaps, commodity swaps, and many other exotic swaps.

Switch option: See chooser option.

Switchback option: The simultaneous purchase of a capped call (floored put) and an up-and-in put (down-and-in call). The instrikes of the knock-in barrier options typically equal the cap/floor strike prices. If the underlying hits the cap (floor) levels, these option would be automatically exercised while of the same time the knock-ins would be activated creating standard puts (calls) for the remaining life of the position. The holder of the position would typically set the strikes at a point he believed to be around a peak (trough) in the underlying. The position benefits from that level being reached and then switches back from call to put (or vice versa) as the underlying itself switches back, retreating (rising) from its peak (trough).

Synthetic: In financial contexts used of any instrument constructed from

others so that its cashflows and sometimes risk/reword characteristics replicate those of another asset or liability. Such instruments are created either because certain users cannot buy the components separately or because an arbitrage opportunity allows the synthetic to be purchased (sold) more cheaply (expensively) than the straightforward product. Almost any position or instrument can be constructed in this way. For example: a call option can be constructed by the simultaneous purchase of a put option and the underlying; a put from a long call and short position in the underlying. A forward can be constructed from a long European-style call and short European put with the same expiration and strike price. See replication.

/agreement for forward exchange (SAFE): The generic term for exchange rate agreements (ERAs) and forward exchange agreements (FXAs). While forwards involve the actual sale and purchase of the underlying, SAFEs are notional principal contracts, like FRAs and are cash settled, FXAs with reference to both the spot rate and forward premium/discounts, ERAs wit reference only to the latter. They were created to overcome capital adequacy requirements which constrained banks in the forward market rather than as a result of demand for an alternative to forwards.

/forward: The combination of a long European-style call and short European put with the same expiration and strike price.

Systemic risk: The bogeyman of derivatives regulators, this is the risk that derivatives permit the transmission of risk across previously unrelated markets, thus making it more likely that a large shock in one will be transmitted (with negative consequences) to others. It is also used of the risk supposedly inherent in the concentration of derivatives business at a small number of large financial institutions. If -- so the argument runs -- one of these were to fail, the whole financial system would be threatened. There is no proof that this is true, despite the regulators' concerns.

T

Table-top: A ratio spread in which the purchase of on option is paid for by sales of the same option at two different strike prices. So called because of the representation of its payout profile.

Tail: The end (left or right hand section) of a probability distribution. Also used by futures traders either of the change in the number of futures contracts needed to hedge a position because of variation margin flows or of the number of excess futures contracts in a basis trade. Also used in the bond or note markets of a security with only a short time to maturity. See kurtosis.

Tau: Used by small sections of the options community for vega.

Tax-exempt swap: An interest rate swap with one or both payment streams based on **tax-exempt** US municipal **bond**
yields or a **tax-exempt** index such as the JJ Kenney.

Tax straddle: Various tax-driven strategies which use swaps and options to make any deductions available early, to defer income, to convert non-deductible cashflows into deductible and vice versa and to window-dress balance sheets by tailoring on- and off-balance sheet portfolios advantageously.

Term structure: The interrelationship of underlying assets of different maturities.

/of interest rates: The interrelationship of interest rates of different maturities. The term structure of interest rates relates spot rates to the term to maturity in the form of the spot or zero coupon yield curve. Modelling the relationships between spot rates at different points in the curve is crucial to the pricing of interest rate derivatives since even a short-term instrument will span several spot rates and so its price will depend on how they interact with each other and the rest of the term structure. The dynamic nature of the term structure has led to the development of multi-factor pricing models where the factors represent changes in the level, slope and curvature of the term structure.

/of volatility: The volatility of the prices or rates of the underlying at different maturities. For example, studies of the term structure of interest rates show that spot rates at different maturities have different volatilities. A basic observation is that long rates are less volatile than short rates and that long-rate volatilities are linked to current short-rate volatilities by mean reversion: short rates tend to be pulled back towards a long-term average. The volatilities of each spot rate are modelled to produce a term structure of volatility -- that is volatility plotted against term to maturity. This is on important input into term structure pricing models.

The term structure of volatility is also sometimes a reference to the differing implied volatilities of options with different maturities. Short-dated options' implied volatilities change faster than those in longer-dated options. Volatility itself also exhibits mean reversion.

/model: A pricing model that uses the information contained in the current term structure of interest rates and also the volatilities of each of the spot rates as inputs into binomial, trinomial or multinomial trees which value the underlying debt instrument at each node, so giving the basis for a valuation of an option on that instrument. Also called whole-term structure models. See Ho-Lee, Heath-Jarrow-Morton.

Termination: Cancellation of a risk management agreement or derivative transaction upon an agreed event and on previously agreed terms and conditions.

Theta (Character omitted): The sensitivity of option premium to the passage of time with the price and implied volatility of the underlying unchanged. The longer the maturity of an option, the more likely it is that the price of the underlying will exceed the strike price of the option, the more likely the option is to be exercised and so the more valuable/expensive the option. The amount of the option's value that is derived from this phenomenon is the option's time value and the rate at which this time value decreases as the option's life shortens is called theta or time decay. An option with a theta of 0.075 will lose 0.075 of its value as the number of days to expiry decreases by one.

Time swap: See accrual swap.

Time value: Often used to mean the difference between an option's premium and its intrinsic value or parity and, by implication, a simple function of the option's time to expiration. In fact, though in general the longer an option has to run the more expensive it will be, the relationship between time and premium is a function of the volatility of the underlying and the cost of carry of the option.

Total return: All the cashflows and capital gains/losses associated with an investment.
/index notes: A bond whose coupon consists of the total return from a bond or equity index plus or minus a spread. For example, such a note might pay

the Merrill Lynch Corporate Bond Index total return plus 25 bp. Since the investor cannot incur negative coupons any negative returns are rolled over and, if necessary deducted from principal at the end.

/option: An option whose payout includes any dividends or interest payments accruing to the underlying over the life of the option. Particularly common in the context of equity index derivatives where index tracking is important.

Touch option: Used of any barrier options and digital options which are activated or deactivated or payout when the underlying touches as opposed to breaches a pre-agreed strike level.

Trigger: Used of many derivatives, derivative combinations and structured notes whose payout is determined or altered by the underlying trading at or through a pre-determined trigger or barrier level.

/forward: A zero cost FX structure in which the purchaser enters into a synthetic or standard outright forward contract at a rate significantly more attractive than the prevailing market rate but which is knocked out if spot reaches a pre-determined trigger level (set in-the-money-forward) either at any time before the expiry of the structure or, in the case of an at-maturity trigger forward, at maturity. The at-maturity trigger forward is less risky because it can only be knocked out if spot hits the trigger at maturity, but in exchange for this the knock-out level is closer to the current spot than with the trigger forward.

So, in a standard trigger forward, if the outright forward rate for US$/Lit was 1668, a trigger forward could be constructed so that the holder could sell US$ against Lira at 1710 in nine months' time unless the rate hits 1450, in which case the structure is knocked out. If the dollar appreciates, the holder of the trigger forward is obliged to sell dollars at 1710; if it depreciates against the lira but does not hit 1450, then the holder can sell at 1710; but at 14550, the whole structure knocks out.

The trigger forward is a combination of a purchased forward and a sold barrier option. The premium received from the sale of this option is what gives the holder of the trigger forward the better-than-market forward rate.

The product is useful for those who believe that there will be a limited move in their favour and who think that the knock-out level is unlikely to be trade. However, if a synthetic forward contract is being used, should the market trade unfavourably, the holder will be obliged to buy (sell) the underlying. The potential benefit to a hedger is that he is able to cover the exposure at a more favourable rate than the current forward. If the trigger level is reached though, the hedge ceases to exist, leaving the exposure unhedged in an unfavourable market.

More complex variants, known as double trigger forwards, incorporate the sale of more than one barrier option to give on even better forward rate but with the possibility of losing upside. An example might be a structure that offered a dollar/yen forward rate of 105, knocked-out at 90 and with a knock-in dollar call at 111. Between 105 and 111 the holder sells dollars at the prevailing market rate.

/option: See barrier option, digital option.

/swap: See curve lock swap.

Tri-nominal tree: An extension of the binomial method of option pricing in which the variable being modelled (the price of the underlying) is allowed

three possible outcomes instead of just two: move up, move down or stay the same. This provides greater flexibility and is useful in pricing more complex products.

Tunnel option: A set of collars with constant strike price covering non-overlapping periods forward from the trade date.

U

Up-and-in: A knock-in barrier option activated when the underlying moves up the rough a pre-agreed instrike.

Up-and-out: A knock-out barrier option deactivated when the underlying moves up through a pre-agreed instrike.

V

Variable maturity swap: A swap whose maturity is uncertain but whose range is predefined. For example a swap whose maturity is between two and three years contingent on Libor reset dates.

Variable strike cap/floor: See periodic cap/floor.

Variance: The statistical measure of how widely a variable is dispersed around the mean.

Vega: The first derivative of the option premium with respect to volatility, vega measures how much an option's value changes for a small movement in volatility. Also known as tau, lambda, epsilon, kappa and eta, it is always positive and is expressed either as the currency change in the value or price of an option for a percentage point change in the standard deviation of the underlying or in points per percentage change in volatility.
At-the-money options are most sensitive to changes in volatility (their vega is highest) while deep in-the-money and deep out-of-the-money options are relatively insensitive. Options are also more sensitive to volatility the longer their time to maturity. Vega is extremely important in hedging options positions because implied volatility can change, reflecting a change in view about further volatility, without any change in the price of the underlying. This means that the option premium may change in value, and so a hedge position may change in value, even if the position is delta and gamma hedged.

Vertical spread: The simultaneous sale of one type of option (call or put) and purchase of the same type of option with the same maturity but a different strike price. See put spread, call spread, horizontal spread.

Volatility: The measure of a variable's tendency to vary over time. This is crucially important in option pricing since the more volatile the price, rate or return on a n asset is, the more likely it is to reach the option strike price and so the more valuable the option. In the Black-Scholes world, volatility is influenced by, among other things, the square root of time: the longer the life of the option, the greater the variance (Black-Scholes does not capture mean-reversion) and the longer the period over which that volatility can work in favour of the option buyer. Annualized volatility is the commonest measure and is usually calculated as the annualized variance or standard deviation of the underlying price, rate or return. Historical volatility is not always a good predictor of future volatility and so is used with caution as an input into pricing models. Whether an option is cheap or expensive relative to its theoretical value depends on the volatility assumed or implied in the model.

Option pricing models differ in their approach to volatility but many make

a number of assumptions which affect the prices they generate. Most importantly, they assume that volatility is constant (stationary) over time. It is not and later models can incorporate this fact, some assuming volatility to be stochastic. And they assume that the continuously compounded returns of the asset (the natural logarithm of the asset price relatives) are normally distributed with a variance that is proportional to the time over which the price change takes place. This implies that volatility will increase indefinitely with time. In fact, financial assets exhibit mean reversion.

/rate agreement (VRA): Agreements to buy and sell volatility only.

/skew: In statistics, skew is the difference between an actual distribution and a benchmark (usually lognormal) distribution. Volatility skew most commonly refers to the difference in implied volatility between out-of-the-money puts and calls. In many options markets, the former have higher implied volatilities than the latter, usually explained by supply and demand. When traders talk of trading the skew, they are generally talking about trying to predict the slope of the implied volatility curve and choosing an option position that profits if their prediction is correct. A negatively sloped implied volatility curve implies a negatively skewed probability distribution for the level of the underlying. The skew implied by the Black-Scholes model is small and positive.

/smile: refers to the influence of the strike price of an option of a given maturity on its quoted implied volatility. Generally the implied volatility of in-the-money and out-of-the-money options is greater than that of at-the-money options. If the implied volatilities are plotted versus the strike, a curved line resembling a smile is obtained.

The Black-Scholes model implies that stock volatility is constant. If true, the implied volatility from European options of all strikes and maturities would be identical. In fact, implied Black-Scholes' volatilities depend on the maturity and strike of the European option in question. That is, the market may believe that extreme upward and downward movements are more likely than allowed by the Block-Scholes model. In this case it is said that the implied market distribution is more leptokurtotic than implied by Black-Scholes. This can be seen when the implied volatility smiles -- is convex in the exercise price. In extreme cases the smile can create a two humped probability distribution, unlike the one-humped probability distribution predicted by Black-Scholes.
/term curve: See term structure of volatility.

/trading: Taking options positions that will profit not from moves in the price of the underlying but from changes in volatility. Traders can take views on absolute levels of volatility by buying and selling combinations of options -- classically delta-hedged straddles and strangles. They can also trade future actual versus present implied volatility, profiting if future actual volatility is more or less than the implied volatility of the position when the trade is put on. So if they believe that the volatility implied by an option is too low, then the option is cheap and they will buy it, delta hedging against directional risk in the underlying.

Buyers (sellers) of volatility profit when the underlying is more (less) volatile than the implied volatility predicted. These trades are nondirectional, that is they are hedged against absolute price moves in the underlying. And traders can arbitrage between the different volatilities of options at different maturities.

The total exposure to volatility of a position is measured by the weighted average of vega. A positive vega position is used if a rise in volatilities is predicted and a negative vega if a fall is foreseen.

W

Wall option: An option structure that profits to the extent that the underlying trades below (above) a certain predetermined level. For example, in an FX wall, a customer specifies a currency rate and pays an upfront premium. For every day during a set period that the spot fixes above (below) the specified rate, a portion of the maximum total payout is locked in. If the spot fixes below (above) the trigger level every day, then the maximum payout will be due. If none of the days satisfies the required condition, then no pay-out will be due. The name wall option is derives from the fact that the pay-off diagram for the option shows a rectangular area of potential payout bounded by a wall representing the maximum profit. Like the simpler range binary option, wall options can be combined with deposits/notes to create yield enhanced fixed-income instruments.

Warrant: A securitized, generally medium- to long-term, option.

Weekly reset forward: A synthetic FX forward where each portion of the contract needs to be activated on a weekly basis. For each week that a pre-determined fixing condition is established, a portion of the contract is locked in. If none of the weekly conditions is satisfied, then the currency is bought (sold) at a more favourable outright rate than the initial prevailing market rate. The product is an alternative for those with cash flows spread over a period of time or for balance sheet hedgers. It provides an opportunity to deal at a rate significantly better than the forward outright rate but only for a portion of the amount corresponding to the frequency that spot has fixed above (below) the trigger level.

Weighted average rate option: An average rate option in which the weighting of each periodic price or rate used in the averaging process varies according to a predetermined schedule. These options are useful if the timing and magnitude of cash flows is known but the price or rate is unknown.

Whole-term structure pricing model: An interest rate option pricing model that takes into account the relationships between spot rates at different points in the curve. Such models are designed to enable the exposure on all interest-rate derivative products to be aggregated. For example, the volatility exposure created by a long position in swaptions should be able to be offset by a short position in caps so that only the net volatility is hedged. See term structure of interest rates.

Wiener process: The description of movements in a variable when the change in its value in a short period of time is normally distributed and the changes in two non-overlapping periods of time are uncorrelated.

Window reset swap: A type of periodic reset swap in which the floating-rate payer is permitted to reset Libor at any time within each reset period, as opposed to the beginning of each period as in a conventional swap, at no additional cost. This embedded option allows the floating-rate payer immediately to take advantage of windows of opportunity presented by declining rates or sudden dips in rates.

Worst of two assets option: A rainbow option in which the holder obtains the returns from the worst performing of two assets.

Write: To sell an option.

Y

Yield curve: A plot of interest rates versus time.

/accrual note: A combination of the CMT-Libor (or other two indices) differential note and the binary or fixed accrual note. A yield curve accrual note might pay a fixed 4.75% coupon in year one, and then 7.125% if 10-year CMT rates minus six-month Libor is between 1.25% and 2.25%. The advantage of using a spread as opposed to an absolute index is that its volatility is lower.

/option: An option on the spread between interest rates at two different points on the same yield curve. They are usually struck on the yield of a longer maturity bond less the yield of a shorter maturity bond. Yield curve calls profit if the yield curve flattens, puts if it steepens. These products allow investors to take a view on the shape of the yield curve without taking a directional view on the underlying bond market. The term is sometimes also used of options on the spread between yield curves in two different currencies -- say, that between five-year French and five-year German interest rates.

/(arbitrage) swap: A swap in which the counterparty moves up or down the yield curve twice in the same swap, yield curve swaps Are a type of basis swap in which a shorter-term floating-rate index is swapped for a longer-term floating-rate index. For example, a counterparty might pay three-month Libor and receive the 10-year Constant Maturity Swap (CMS) rate.

A yield curve steepening trade is one in which the buyer believes that the spread between short and long rates will widen. He might choose to receive the 10-year CMS less a spread and pay six-month Libor. This trade profits if 10-year rates go up and/or Libor goes down.

A yield curve swap can be viewed as a series of forward swaps each of which starts on the yield curve swap's reset dates. (This is also one way to hedge them but in practice it is expensive and hedging is done on a portfolio basis).

In the commodity markets such swaps are known as contango and backwardation swaps depending on whether the forward curve is positively or negatively sloped.

You choose option: See chooser option.

Z

Zero-cost (premium) collar: A collar in which the premium received for the sale of one component of the collar exactly offsets the premium paid for the other component.

Zero-coupon swap: Functionally a loan, this is an interest rate swap in which the floating payment streams are usually conventional but the fixed-rate payments are deferred until maturity. It can also be used to hedge the payment stream on a zero coupon bond. See reverse zero coupon swap.

Zero-coupon yield curve: The spot rate curve of the observed or interpolated yields to maturity of default-free zero coupon bonds plotted against maturity. From this a forward rate curve or forward term structure can be implied to give the markets current expectation of future spot rates.

Zero-premium cap/floor: See self funding cap/floor.
Zero strike price option: Options with a strike price of zero or close to zero. These are tax-driven and are used as a way of synthetically transferring securities between counterparties where actual transfer would

incur heavy taxation.

Zeta: See vega.

Example of an FX range **floater**

Most range FRNs structured these days are either FX accrual **notes** or binary FX accrual **notes**. These are range **floaters** whose range is not based on Libor but on a particular reign exchange cross-**rate**. The difference between the two instruments is that a binary accrual **note** pays no more interest if the range is broken, regardless of where the underlying trades in future, while a straight accrual note resets every three months.

A common example of the use of an FX accrual **note** might be an investor who believes that the US dollar/yen **rate** will remain in the 90 to 105 range over the next six months. They could enter into a range **floater** deposit for six months that paid Libor+250 basis points on days when the dollar/yen trades within that range and pays zero when outside this range.
Assuming that the investor would alternatively earn Libor flat on his deposit, the client will break even with on ordinary deposit if the FX rate trades within the range for 127 days out of 180 days ((6.00 + 2.5)/6.00 x 180 days). If they believe that the FX rate will be in this range less than 127 days, they should not enter the range floater.

The range floater is constructed from a series of doily digital options. Each day the underlying is within the range, one digital is automatically exercised. The range floater will accrue interest equal to the digital payoff. The cost of the series of digital options is the original Libor that the investor potentially gives up. The expected payout of each digital is then averaged (weighted for the maturity date) and the result is the coupon on the note or deposit, in this case Libor plus 2.50%.

Example of a foreign exchange knock-out option

Ordinary FX options provide the buyer with unlimited upside and a known downside--the premium. The knock-out feature limits the upside given to the buyer and therefore makes the option considerably cheaper.

When an investor purchases an ordinary FX option, the payout depends on where the spot rate closes on a particular day (the maturity of the option). With the knock out feature, if at any time up to and including the maturity, the knock-out level (the outstrike) is reached, the option will expire worthless. Where the barrier on a call is above the spot, the option is known as an up-and-out call. Where the barrier on a call is below the spot, the option is known as a down-and-out call.

So, a treasurer may have a view that the US dollar will strengthen from current lows against the Yen over the next six months (current spot 95). He could purchase an ordinary six-month dollar call/Yen put at a cost of around 3.50%. Alternatively, he could purchase a dollar at-the-money call with a knock-out at 109.00--that is, an up-and-out call. This would reduce the premium to just 1.00% with the following result:

If the dollar does strengthen, but trades above 109.00 over the life of the option, the call will expire worthless.

If the dollar strengthens, but never reaches 109.00 over the life of the option, the call will behave like an ordinary call and the investor will exercise the call and make the same profit as the ordinary call.

If the dollar does not close above the call strike (99.00), the option will expire worth less like an ordinary option.

The premium reduction is the result of the fact that while the price of a vanilla option takes the entire normal distribution of possible prices for the underlying into account, the knock-out removes many of those possible values. The knock-out feature is very sensitive to moves in the underlying, particularly when the knock-out price is approached. Marking these products to market is therefore less straightforward than with standard options.

**THIS IS THE FULL-TEXT.**



**Descriptors: Derivatives; Securities markets**
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**A guide to taxable debt financing alternatives.**

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A guide to taxable debt financing alternatives

The 1986 Tax Reform Act imposed tighter restrictions on the purposes and structure of municipal **bond** offerings, eliminated certain types of projects from the **tax-exempt** market, and added new regulations that make even the most traditional public projects more complex and difficult to finance.

The 1986 Tax Act gives 501(c)(3) (private, not-for-profit) hospitals continued access to the tax-exempt market, albeit under more stringent regulations. Private 501(c)(3) borrowers are now included under the umbrella of "private activity" bonds, but qualified 501(c)(3) bonds are excluded from state volume caps and the bond interest is subject to alternative minimum tax computations, as it is with other private activity bond issues.

Proprietary hospitals, for-profit healthcare ventures, and other "private" non-manufacturing borrowers were shut out of the tax-exempt market effective Dec. 31, 1986, under the 1984 Tax Equity and Fiscal Responsibility Act.

Limitations

The two most significant provisions in the Tax Act for healthcare bond issuers are the new limitations placed on investment earnings from **bond** funds (arbitrage rebate) and the considerably tighter restrictions on the amount of **tax-exempt** **bond** proceeds that can be used for facilities designated as "private use."

The arbitrage rebate provisions were designed to eliminate blind pooled financing programs by restricting the investment yield on bond proceeds, thereby eliminating any arbitrage profit that could be used to cover the non-asset portion of pooled financing programs.

Most relevant to healthcare organizations are the restrictions placed on the amount of proceeds used for private activities within an otherwise qualified 501(c)(3) or governmental bond issue. Examples of private activities include a medical office building or a joint venture project with private physicians or commercial partners.

Prior law permitted up to 25 percent of the proceeds of a tax-exempt financing, net of issuance costs and reserve funds, to be used for private purpose facilities. The 1986 Tax Act reduced this 25 percent limit to 10 percent for public hospital issues and 5 percent for private, not-for-profit institutions.

In addition, because issuance costs such as underwriting and legal fees are now counted toward these limits, only about 8 percent of a governmental issue or about 3 percent of a 501(c)(3) issue are available for actual construction and equipment expenditures on any private activity project.

For example, consider a $40 million bond issue with a $4 million reserve fund, $1 million in issuance costs, and $35 million remaining for construction, equipment, and capitalized interest. Prior to the 1986 Tax Act almost $9 million would have been available for private facilities. Under the new law, this amount is reduced to approximately $2.6 million for governmental hospitals or $800,000 for 501(c)(3) hospitals. In either case, while this amount might cover some equipment purchases, it would hardly be enough for a substantial project such as a medical office building.

While public hospitals appear to have a somewhat higher threshold of non-governmental use, their 10 percent limit not only covers individual or commercial entities, but also 501(c)(3) organizations. A bond issue in which more than 10 percent of the proceeds went to a related, but private 501(c)(3) entity could still be issued on a **tax-exempt** basis, but under the aegis of a qualified 501(c)(3) **bond** rather than a governmental bond.

In addition to the private use tests, there are a few other new restrictions affecting healthcare bond issuers. The security or payment test states that no more than 10 percent of the debt service on a governmental bond may be secured by or paid from non-governmental sources. Also, the related use test limits to 5 percent the portion of the project involving a non-governmental activity whose purpose is unrelated to the government facility being financed with the other 95 percent.

While the rules for public hospitals may be somewhat looser than those for private 501(c)(3) organizations, the net result of the Tax Act in either case is to make it considerably more difficult today to finance medical office buildings, joint ventures, and other common diversification activities on a tax-exempt basis.

Out of this problem has sprung opportunity, and the investment banking community has responded with the development of a larger and more viable market for the taxable debt securities of traditional issuers of municipal bonds. Municipal borrowers used $3.8 billion in taxable debt in 1988, but health care accounted for only $35 million of that amount.(a)

In some cases, conventional tax-exempt financing structures have been replaced with similarly structured, albeit taxable, products and sold to taxable debt buyers. In other instances, municipal borrowers have issued securities structured in a manner similar to a corporate debenture or note offering.

The investment banking industry has attempted to educate investors about municipal issuers and credits and to inform traditional tax-exempt issuers about ways to access the taxable debt markets to minimize the interest rate premium paid on taxable securities. a. The Bond Buyer 1989 Yearbook, (New York: American Banker Bond Buyer, a division of International Thomson Publishing Corp., 1989).

Differences in markets

In many respects, such as the average issue size, number of issues, and sources of investment capital, the market for taxable debt securities is very different from the municipal **bond** market. For instance, in 1988 the **tax-exempt** new issue market consisted of approximately 7,000 issues averaging $15 million, while in the corporate market, there were about 1,000 issues averaging $150 million.

The taxable bond market is also far more institutionally dominated than the municipal bond market.

Institutions hold 75 percent of the corporate and foreign debt, compared to 37 percent of tax-exempt debt (see Exhibit 1). The primary institutional purchasers of taxable securities include pension and endowment funds, which pay no taxes and thus do not participate in the municipal market.

With fewer issuers and larger bond issues, the corporate bond market is centered in New York and other international financial centers, and a few of the largest New York investment and commercial banking firms handle most of the trading.

While the municipal market does have some large, high profile issuers--state governments, major cities, public power agencies, and a few well known healthcare systems--the majority of issues are traded on a regional basis among local individuals and institutions and within a comparatively limited circle of national institutional buyers. One reason that municipals are traded regionally is that individuals often look for the state tax-exemption feature in addition to the Federal tax-exemption feature.

Corporate issues usually total at least $50 million and commonly range from $100 to $500 million. These bonds are typically sold with one term (or bullet) maturing in seven to 15 years. Having a single $100 million maturity creates a very liquid secondary market with bond dealers trading in and out of millions of dollars of bonds on behalf of major institutional investors.

In contrast, a typical bond issue in the municipal market ranges from $5 million to $40 million and breaks this amount into a string of serial maturities in amounts from $100,000 to $500,000 and term maturities several times larger.

The most important difference to the healthcare issuer, however, is the interest rate differential. Over the past five years, long-term taxable securities have averaged a 1.7 percent higher yield than tax-exempt bonds. This relationship is not constant. The yield differential has ranged from 0.8 percent in April 1986 to 3.5 percent in May 1984. As of May 4, 1989, it stood at about 3 percent. Factors influencing this yield differential include supply and demand as well as changes in the tax law.

Taxable debt alternatives

As hospitals step into the taxable debt arena, they will have available to them, at least in theory, the entire spectrum of financing options available to any U.S. corporation.

For some hospital systems evolving into billion dollar businesses, this theory may become a reality. However, unless tax-exempt financing is eliminated altogether, most hospitals will have more limited needs for taxable debt financing and a more limited range of practical options for gaining access to this market.

The past decade has seen an explosion in the size, sophistication, and globalization of the U.S. and international debt markets. A broad range of interest rate terms, maturities, currencies, and other features is available.

COMMERCIAL PAPER.

Commercial paper describes short-term, unsecured promissary notes issued by industrial corporations, utilities, financial institutions, and municipalities with high quality credit. Today, outstanding commercial paper totals approximately $360 billion.

Commercial paper is a flexible and low cost form of short-term financing often used for funding construction and working capital needs as well as completing capital structure diversification and other financing requirements. The notes are drawn to the order of the bearer, primarily as a result of the impracticality of registering securities with such short maturities. Furthermore, the notes are fully negotiable with a maturity not exceeding 270 days. Most maturities are concentrated in the 28-day to 45-day range with denominations genrally in multiples of $1 million.

Taxable commercial paper is sold on a discount basis, rather than on an interest bearing basis, with the discount determined by the maturity of the notes, the creditworthiness of the issuer or its credit support, and general market levels of various short-term securities competing for the funds of the institutional investor. The primary risk of a commercial paper program is the variable interest rate exposure.

Commercial paper issuers with a "AAA" or "AA" credit rating in the taxable market frequently have the ability to offer programs supported only by the issuer's creditworthiness and without the use of a bank letter of credit. For issuers with credit ratings of less than "AA," however, this market usually requires some form of credit enhancement and liquidity support in connection with the issuance of commercial paper.

Credit enhancement is typically a bank letter of credit that guarantees investors will receive principal and **interest** in the event of an issuer **default**. A line of credit provides liquidity support to an issuer, but does not provide a guarantee of the repayment of principal and **interest** in the event of issuer **default** . The liquidity support provides a loan to issuers in the event that the issuer is unable to place large amounts of maturing commercial paper with investors.

The line of credit will enable the issuer to buy back and hold the maturing securities until they can be sold to investors. Because there are limits to the amount of credit extended, an issuer with severe liquidity problems may deplete all available credit sources and be forced into default. In such cases, only credit support will provide investor protection.

A commercial paper program in the taxable market should generally total at least $50 million to be efficiently and economically distributed. Within the healthcare industry, the use of commercial paper will be limited to large hospital systems or **taxable** pooled financing programs. For smaller needs, other products, such as taxable variable **rate** demand **notes**, may provide a more suitable and more economical method of financing.

TAXABLE VARIABLE **RATE** DEMAND **NOTES**. Traditional municipal issuers historically have found it difficult to access the taxable **floating rate** market because of certain minimum size requirements that exist for taxable programs. In general, commercial paper programs of less than $50 million are difficult to market and often are not cost effective for the issuer.

**Taxable** variable **rate** demand **notes** make it easier to gain access to the **taxable floating rate** market. The **notes** can be sold with par (face value) amounts as small as $10 million and are marketed to many of the same investors that purchase traditional **taxable floating rate** instruments, including money funds, corporations, pension funds, banks, and trust departments. The benefit to many investors is that the interest **rate** of the **notes** is set at a level that will permit the bonds to be remarketed at par. The interest **rates**, which are reset every seven to 30 days, are slightly

higher than yields on 30-day commercial paper.

Issuers may call (prepay) the **taxable variable rate** demand **notes** on any monthly interest payment date, thereby providing an opportunity for issuers to refinance these short-term **obligations** with long-term bonds should market conditions make this alternative attractive. Municipal issuers may also find it attractive to hedge the **floating rate** with an interest **rate** cap or swap.

**FLOATING RATE NOTES.**

Another form of variable **rate** taxable debt that is more like a conventional corporate financing instrument is **floating rate notes** (FRNs).

PHOTO : EXHIBIT 1: Holders of tax-exempt, corporate and foreign debt

FRNs differ from commercial paper or **taxable** variable **rate** demand **notes** in that they do not involve any remarketing (or put) system to adjust the **rate** to changing market conditions. Rather, the interest **rate** is adjusted periodically according to a formula tied to accepted market indexes such as the London Interbank Offered **Rate** (LIBOR) or the 91-day U.S. Treasury Bill rate. The coupon adjustment formula generally adds a positive spread over the base rate with interest payments often occurring with the same frequency as coupon adjustments.

The FRN market has evolved significantly since its inception in the late 1970s. It is an attractive alternative to commercial paper for issuers wishing to borrow at a floating short-term rate with a long-term stated maturity and without the put risk of commercial paper.

Final maturities in excess of five years frequently require periodic investor puts prior to maturity. Yet unlike commercial paper and tax-exempt floating rate securities, FRNs do not typically include investor put options on each interest reset date. The appropriate maturity for FRNs that are marketed at a specific time is largely dependent on existing investor demand and market conditions. FRNs are usually structured to permit issuer calls on specified dates after an initial non-callable period.

Because FRN coupons are generally stated as a fixed relationship to a reference or base index, the investor is not assured that the security can always be sold at par. Therefore, the investor is subject to principal risk to the degree that the issuers' credit deteriorates or investor appetite for FRNs decreases. Most healthcare issuers of FRNs will also require credit enhancement and a bank liquidity facility to establish an FRN program.

MEDIUM-TERM NOTES. Recently, while the taxable commercial paper market was expecting rapid growth, issuers sought opportunities to extend into more lengthy maturities under a format similar to commercial paper. The development of medium-term notes (MTNs) provided a solution. More than $6.5 billion worth of MTNs are currently outstanding.

MTNs are an intermediate-term security offered on a continuous basis, providing flexibility--similar to commercial paper programs--for an issuer to vary the amount of outstanding notes as funding requirements change. The broad range of possible maturities enables an issuer to borrow at the most attractive point on the yield curve at the time of each issuance. MTN maturities range from 271 days to 15 years. The majority of MTNs are sold with maturities of between three and seven years.

These securities are generally structured as senior unsecured obligations of the borrower, but they can be issued on a secured basis to enhance the quality of the notes or on a subordinate basis if the issuer is of sufficiently high credit quality. MTNs can be issued domestically or abroad.

MTNs of $5 million to $20 million can be issued without the borrower having to pay a premium for a lack of liquidity. This, together with the fact that MTNs are generally structured with short to intermediate maturities, makes this financing vehicle a viable alternative to serial bonds.

LONG-TERM DOMESTIC PUBLIC OFFERING. The U.S. domestic public market typically will be the most cost effective source of funds for issuers of taxable debt in the 20-year to 30-year maturity range. The structures of fixed-rate taxable debt offerings, however, often differ in several ways from the structures historically used by issuers of fixed rate tax-exempt municipal debt. The more important differences include the investors in the market, issue size, and structural differences.

Individuals make up the largest investor segment in the tax-exempt market with banks, insurance companies, and funds making up the remaining portion. The investor mix for domestic corporate bonds consists primarily of banks, insurance companies, pension funds, and state and local governments. Individuals do not play an important role in the long-term taxable market.

A typical tax-exempt municipal issue is only a fraction of the size of a typical corporate debt issue, which often ranges from $100 million to $200 million in par amount. A $100 million issue is considered large enough to be widely distributed, thereby providing investors with the required liquidity.

The taxable market historically has displayed a strong preference for bullet maturities of less than 10 years, with no amortization or redemptions prior to maturity through a sinking fund. Sinking fund redemptions are more common with 20-year to 30-year debt, which often have sinking fund payments beginning in the 11th year. Immediate sinking fund redemptions are not readily accepted because of problems with trading these securities.

Because of their small size and resulting lack of liquidity, serial bonds are not often seen in the long-term taxable credit markets. Medium term notes can be used as an alternative to serial bonds and combined with a term bond to provide a lower cost of funds. As the volume of municipal financings in the taxable market grows, however, "municipal-like" structures are expected to gain greater acceptance.

Investors in corporate debt usually demand strong call protection and have a preference for bonds that are not callable for the life of the issue (commonly referred to as non-call life). Call provisions that permit a 10-year call at a price of par plus one-half of the coupon, which declines in equal increments to par in the 20th year, are common for bond issues with longer maturities. Shorter periods of call protection, such as a five-year non-call period, would require an additional premium.

Alternative call provisions, similar to those typically seen in tax-exempt municipal transactions, are possible but will cause the issuer to pay an additional yield premium because of the taxable market's greater concern about call protection.

DOMESTIC PRIVATE PLACEMENT. The domestic private placement market is an important alternative to the public market for municipal issuers entering the taxable arena. The private placement market is especially attractive for weak credits, complicated credits, and bond issues of small size, all of which would have difficulty in the taxable public markets.

The private market generally demands higher yields than the public market for better credits. However, the private market premium normally disappears for credits rated at or below the "BBB" level. In some instances, the higher yield necessary to market a small or complicated financing in the public market could also offset the private market premium.

The private placement process usually can lead to commitments in a shorter period of time than is possible in the public market. These commitments from investors are subject to subsequent due diligence, investors' finance committee approval, and satisfactory legal documentation.

Each investor may require a visit to the municipality or agency before bringing the transaction before its investment committee. The completion of legal documentation would follow, typically leading to funding within about two months from the date of investor commitment.

Delayed takedown of funds may be negotiated at the time an interest rate is agreed upon, with no commitment fee or rate penalty for periods as long as six months.

Issuance costs for a private placement are often less than those for a public offering. The lack of registration, legal opinions, and printed offering documents means most private transactions can be completed in seven to 13 weeks.

Issues as small as $1 million and as large as a $300 million have been privately placed with a limited number of investors, but the majority of privately placed issues are in the $25 million to $50 million range.

Although transactions with a broad range of maturities can be sold in the private placement market, maturities in the five-year to 10-year range dominate, with pockets of 30-year money periodically available. Unlike the public market, a sinking fund bond structure is preferred and in many cases is required for longer term transactions.

As in the taxable public markets, call protection is extremely important in the private placement market. It is common to see privately placed bond issues that are non-callable for the life of the security. For a 30-year offering, 20-year call protection is often provided. The private placement market often requires "make whole provisions" rather than set call premiums as a form of compensation in the event of a call, particularly in the earlier years of a long-term issue.

A make whole provision is often necessary because investors frequently establish hedges or match their investment with the expected life of their assets. In cases where an issue is called prior to maturity, the investor will likely incur a substantial cost associated with unwinding these hedges. The term of the offering, therefore, provides that the issuer be able to recover these costs (or be made whole). The disadvantage of such a provision is that, unlike a set call premium, the cost associated with a make whole provision is now known in advance and may expose the borrower to excessive expenses in the future.

Financing authorities

The legal authority for tax-exempt financing by private 501(c)(3) hospitals is based on the use of public authorities that serve as "conduits" to pass on the benefits of tax-exempt interest rates to their borrowers. While many authorities, particularly statewide authorities, provide other services as part of a financing, the central feature of their relationship to hospitals is the authorities' ability to secure funds on a tax-exempt basis.

Whether it would be in a private hospital's interest to continue involving a public authority in its taxable financings depends on a variety of factors. Among these are state invome tax considerations, existing bond financing convenants, costs, and other, perhaps less tangible, benefits of using an authority.

In most states, the use of a public financing authority will continue to allow the bond interest to be exempt from state income tax even if it is not exempt from Federal income tax. If the local or in-state investment market, particularly among individual investors, is large enough to absorb a substantial portion of the offering, then this state exemption can yield a small but meaningful difference in the interest rate.

The amount of this difference will depend on, among other factors, the level of state income tax rates. In places like New York City, which has both local and state taxes, the difference can be substantial.

Another source of cost savings from use of a public authority may be state-level securities registration requirements. Typically, using an authority will exempt an offering from extensive state registration and filing fees. These same exemptions may not be available to an offering directly issued by a not-for-profit corporation where, if extensive retail investor participation in the issue is expected, requirements for state clearance may lead to considerably higher costs.

SEC requirements

Most publicly issued debt or equity of corporations must be

registered with the Securities and Exchange Commission (SEC) under the provisions of the Securities Act of 1933. Traditional municipal borrowers have generally avoided this requirement under exemptions granted for states or political subdivisions and charitable 501(c)(3) organizations.

Exemption from SEC registration in these instances does not hinge on the tax-exemption of the **bond** interest, but rather on the fact that the securities issuer or borrower is a **tax-exempt** entity under the 1933 Act. Therefore, even though a particular project may not qualify for tax-exempt financing, it still may be exempt from SEC registration if the issuer is a government or not-for-profit organization.

However, if a for-profit organization or for profit subsidiary of a not-for-profit corporation either directly issues public debt in its own name or through a conduit authority, its debentures (or the loan agreement with the authority) will likely be subject to SEC registration. Even in this instance, registration may be avoided by completing the financing through a private placement, by backing the issue with a bank letter of credit, or by issuing very short-term debt such as commercial paper.

**Captions: Holders of tax-exempt, corporate and foreign debt. (graph)**


**Special Features: illustration; graph**
**Industry Codes/Names: HLTH Healthcare**
**Descriptors: Financial markets--Analysis; Healthcare industry--Securities; Taxation of bonds, securities, etc.--Analysis**
**Product/Industry Names: 6231 Security and commodity exchanges; 8000 HEALTH SERVICES**
**File Segment: TI File 148**
**Statute Name: Tax Reform Act of 1986---Interpretation and construction**